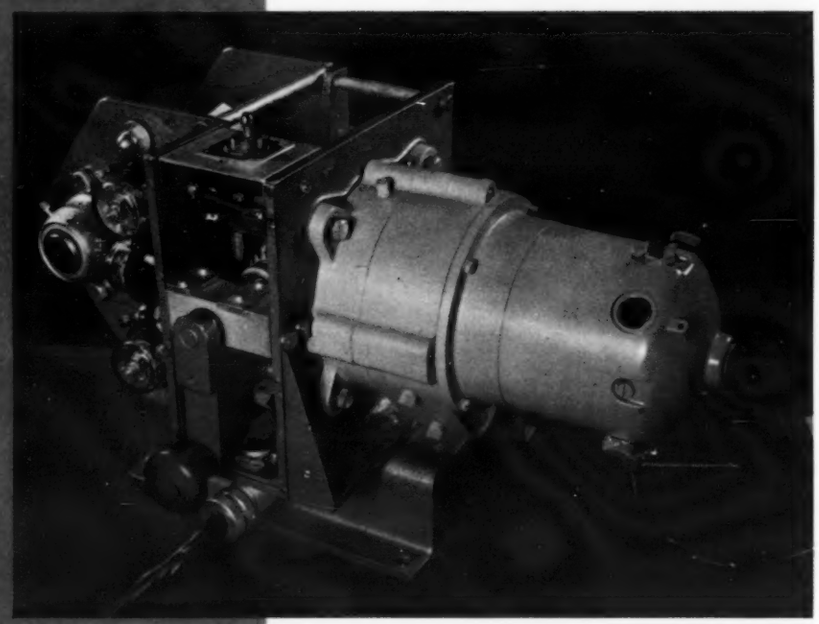
Design News



Mechanical linkage moves car door with harmonic motion. Page 10

A CAHNERS PUBLICATION

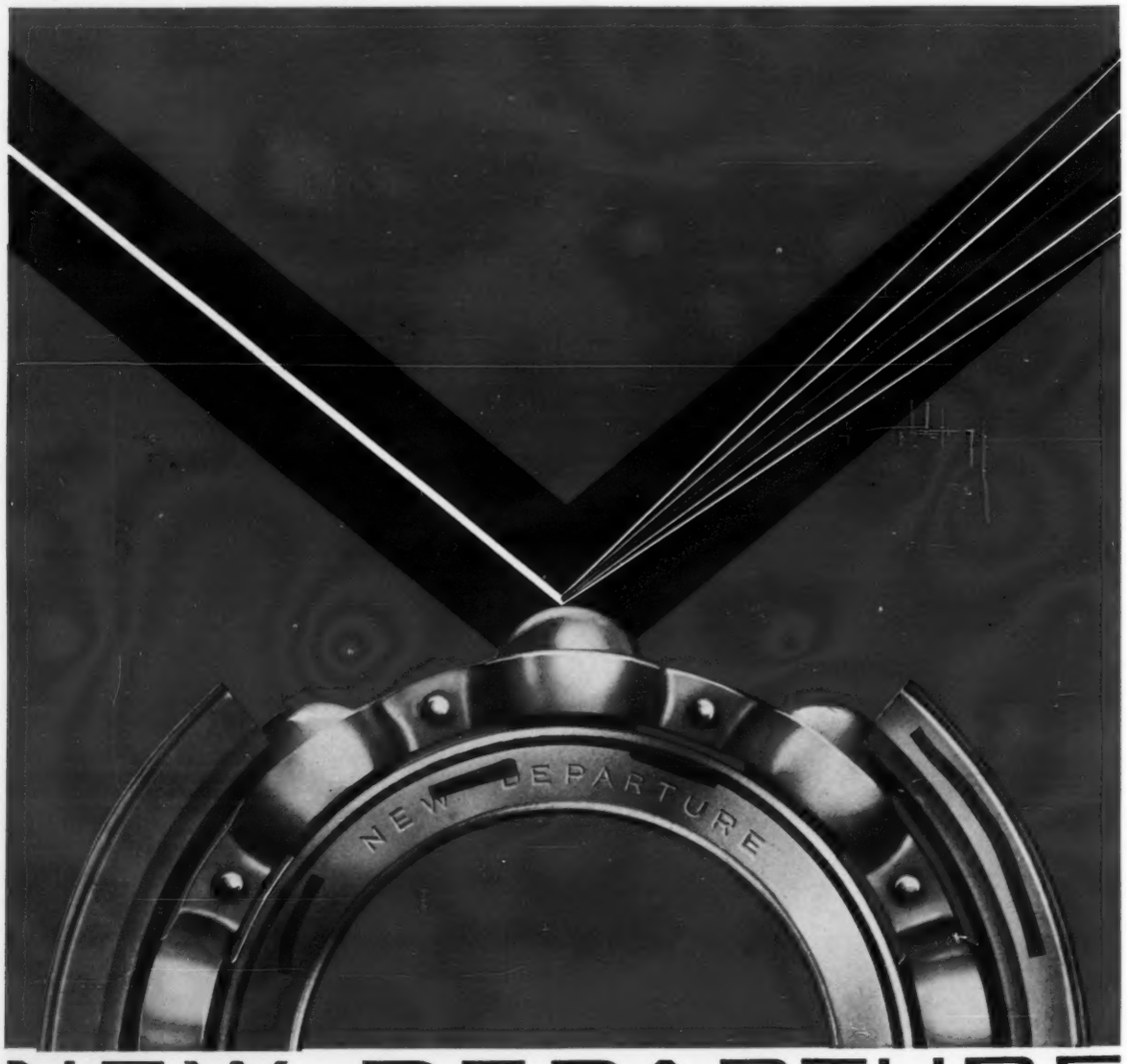
NOVEMBER 24, 1961

NONDESTRUCTIVE INSPECTION DEVICES SEEK OUT MINUTE FLAWS —help New Departure make better bearings!

One such device is *the N/D Ball Scanner*. As eagle-eyed instruments, they subject balls coming down the lines to the closest scrutiny. With unfailing consistency, they automatically reject balls having the minutest traces of rust, pits, grind marks, blemishes, and other faults, normally undetected by visual inspection. Result—balls made by New Departure are more defect-free than ever before. Bearings assembled with these balls and used in your products deliver better performance with greater reliability.

Development of nondestructive inspection devices has long been one of New Departure's principal R & D efforts. The Ball Scanner is just one of the existing devices that are already bringing you higher quality and more reliable bearings. Others are still under "wraps," but are destined to bring you even better bearings in the near future.

The advantages of these ball bearings are available to you now. Contact the New Departure Sales Engineer in your area. New Departure, Division of General Motors Corporation, Bristol, Connecticut.



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Design News

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This Card Good Until
January 22, 1962

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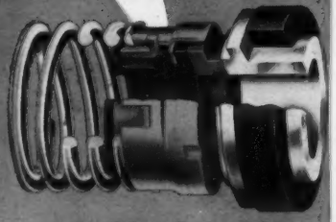

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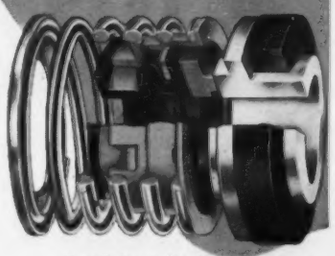

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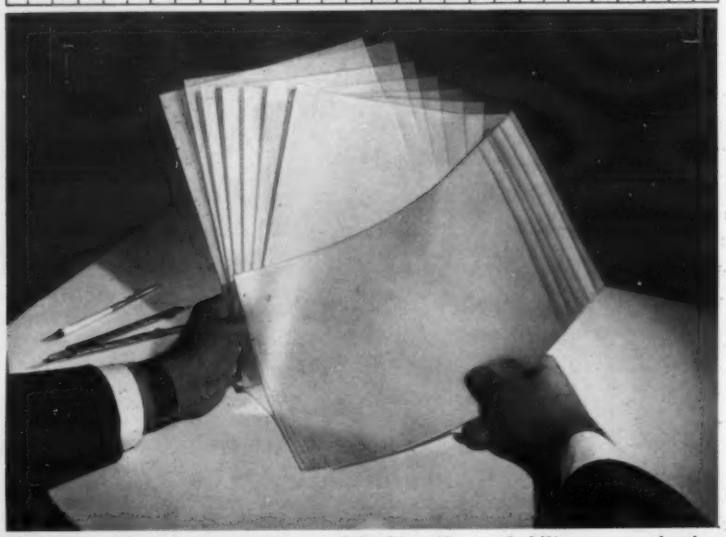
DRAFTING TRENDS



Appearance is not a good indicator of drafting film workability or reproduction quality—see test offer below.

In drafting films, it's the coating that counts

Film Similarities

All drafting films share one common characteristic—*every* major brand employs a polyester base. This polyester material may vary somewhat in grade (from clear to milky) or in gauge (from .002 to .007). However, its properties remain so nearly identical that no appreciable difference in print-back speed can be noted by exposing diazo material through the uncoated film. Accordingly, all polyester films have these unique features: dimensional stability, transparency, flexibility, moisture-resistance and tear strength.

Coating Differences

These advantages mean nothing to the engineer, draftsman or architect until a surface receptive to pencil and ink is put on the film. Post applies three distinct micro-coatings to its polyester film, baking these elements and the film at such high temperatures that they are literally fused. This process also "preshrinks" the material, endowing Polytex with slightly greater dimensional stability.

More Drafting Latitude

The net result of the exclusive Post *coating process is the most durable drafting film surface available*—a surface on which, if circumstances demand, you can use the hardest grade of pencil without destroying the coating. Some pencils work better than others, of course. Plastic-based pencils are best of all when permanency or washability are considered.

Test Offer

To convince you, regardless of previous or present drafting film experience, that Post Polytex offers a superior coating with outstanding erasibility, pencil and ink adhesion, a free Polytex test kit is yours without obligation. We'll mail an 8½ x 11 drafting film sample, plus a vinyl eraser and drafting pencil assortment, packed in a Post Pocket Protector. Write for it on your letterhead today. *Frederick Post Company, 3650 N. Avondale Avenue, Chicago 18, Ill.*

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SOUNDING BOARD

FOR OUR READERS

Helium-Tight Fittings

Stanford Research Institute has been designated by Lockheed Aircraft Corp. to survey and evaluate available and potentially available hydraulic and pneumatic fittings.

In particular, on the basis of this survey, we seek to select a suitable tubing fitting for use in missiles and space vehicles. The principal criterion for selection will be the ability to remain helium-leak tight even after exposure to the extreme environmental conditions of ground handling, atmospheric boost, suborbital boost and space.

It is our hope that the survey and evaluation will result in the selection of a new fitting to replace the military standard types in rocket-propelled vehicles. We fully realize that a suitable fitting could be currently in use outside of the missile and aircraft industry and, therefore, prior to embarking on a full development program, we want to explore all potential areas of availability.

SRI is conducting a general literature survey, contacting all known fitting manufacturers and distributors and following any lead that might result in a new and different type of tubing fitting. We know that you, as the editor of a widely distributed trade journal, could provide valuable assistance to our program. As a regular reader of your magazine, I have noticed fitting ideas from time to time and wonder if there is any way we could be furnished abstracts, reproduced articles, reference lists or anything else we could use in our survey; additionally, a small insert, article editorial or reproduction of parts of this letter in your magazine would reach more potential areas throughout the country than all our survey efforts combined.

Adrien J. Aitken
Mechanical Engineer
Propulsion Sciences Div.
Stanford Research Institute
Menlo Park, Calif.

• We are searching our files. Meanwhile, can our readers help?

Slips and Slip-Ups

I have always enjoyed and found value in each issue of Design News. Now, as an unemployed design engineer, I have time for a little closer examination of the magazine. Constructively speaking, I believe I have found two errors in the Sept. 29th issue.

On page 114 the drawing of the timing-belt gear pump must be in error with respect to the location of the inlet and outlet ports of both the top and bottom gear. There would be a very small exposed port area and hardly any capacity with ports as depicted.

Also, on page 135, the graph and caption both must be in error in comparing the Buick V-6 -198 engine with a typical current "V-6" engine. I believe this should read "typical current in-line-6 engine". The article above the graph also speaks of the "in-line V-6". When I've seen that one I'll have seen them all. . .

Jack P. Blomgren
Myrtle Beach, S. C.

• Mr. Blomgren is right regarding the location of the ports on page 114. The ports should have been approximately in the position shown in the photograph on page 115. Regarding his comments on a "V-6" engine, both GMC and Lancia are currently producing the "V-6" engine. We do agree, however, that there is no such thing, of course, as an "in-line V-6"—this must be written off as a typographical error.

In your Sept. 29, 1961, issue of Design News, on page 152 you have an article entitled "100,000 Pieces of Pi".

In spite of your attention to detail in giving the first and last groups of the value of π to 100,000 decimal places, I believe you "goofed" in describing the last group of digits as "digits 99,990 through 100,000". If you could count the digits in this last group, you will see that they are digits 99,991 (not 99,990) through 100,000.

Lester Glickman
Technical Director
Quality Evaluation Laboratory
U. S. Navy Central Torpedo Office
Newport, R. I.

• Sorry, we counted one thumb twice.

'Sheetrock'

In the Sept. 15 issue of Design News, we noticed "Sheetrock" had been used generically in the caption on the lower right-hand side of page 88.

"Sheetrock" is a trademark of United States Gypsum Co., for what is generically called "gypsum wallboard". There are a number of manufacturers of gypsum wallboard, but only one manufacturer of "Sheetrock" gypsum wallboard.

We hope that when you find future occasion to use "Sheetrock", and we hope it will be often, you will remember to use it as a trademark.

L. J. Lovejoy
Publicity Manager
United States Gypsum Co.
300 W. Adams St.
Chicago 6, Ill.

• Our apologies to the United States Gypsum Co. for neglecting to indicate that "Sheetrock" is a trademark.

International Idea Exchange

You may have noticed an addition to our mast—G. A. Walker, Director of our Idea Exchange Program. Jerry heads up a new department within Cahners Publishing Company. For some time it has been evident to us that publishing is only one facet of the broad concept of communication and exchange of ideas. Through our graphic journalism concept we have been presenting to you many design ideas in each issue. Now we are embarking upon a more ambitious program.

In order to promote an increase in the exchange of ideas between engineers, DESIGN NEWS will sponsor a series of seminars overseas. The first overseas seminar starts January 10, with a group of about 30 engineers from the automotive field. These engineers will attend a series of planned, small-group discussions at Rolls Royce and BMC in England, Renault and Citroen in France, Mercedes-Benz and Porsche in Germany, and Fiat, Lancia and Farina in Italy. In addition, they will have meetings with officials of the Common Market in Europe as well as with representatives of a European professional automotive society.

As a plus, there will be week-end sightseeing trips in Paris, Munich and Rome.

Other seminars planned for 1962 include a February tour timed to coincide with the 5th Annual "Salon International des Composants Electroniques" in Paris, Febrary 16-20. Other seminars in the planning stage are in the general fields of machine tools, instruments and controls, aircraft and missiles.

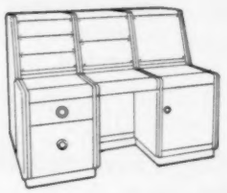
This "engineer-to-engineer" contact will result in a greater understanding of common engineering problems and their solutions. Not only will the engineers attending these seminars get acquainted with their counterparts overseas, but they will also get acquainted with each other. There will be ample time to discuss problems within the group itself.

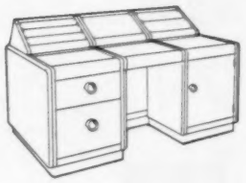
Developed for the engineer-readers of DESIGN NEWS, the Cahners Idea Exchange Program represents a considerable investment. We believe it will be a major contribution to engineering communication. Your active participation and suggestions can make this effort even more meaningful. Further details will be outlined in future issues. Watch for developments in this new field of communications pioneered by DESIGN NEWS.

J. C. Dubois

Executive Editor

EMCOR® STANDARD CABINETS





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DESIGN NEWS SPECIAL REPORT

Design News
Salary and Status Survey

Third Annual Inquiry of Engineers and Designers in Industry

Participants

As before, participants were selected by a consulting firm as a statistically accurate random sample from the DESIGN NEWS mailing list, assuring a wide geographical distribution and broad coverage of the field.

Respondents

Inadvertently, return envelopes were omitted from the original mailing. Although many questionnaires were returned, a duplicate mailing was made. 42.7 percent of the questionnaires were returned.

The Questionnaire

This year's questionnaire was, for the most part, a duplicate of last year's form.

'Average'

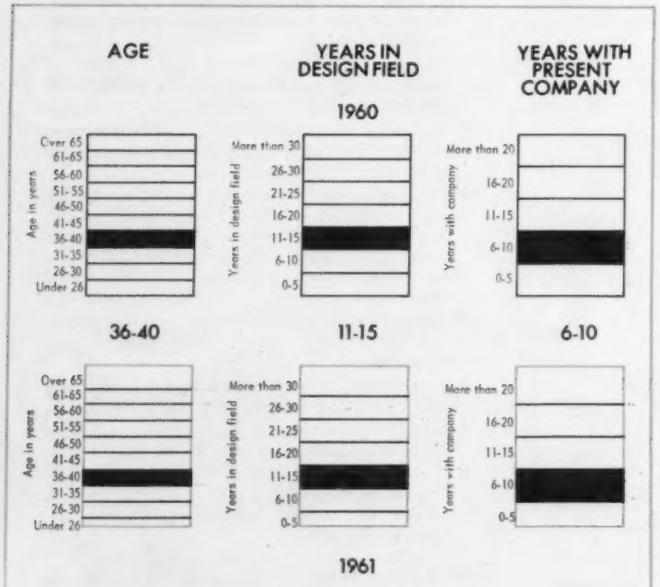
The term "average" used in the accompanying graphs indicates the arithmetic mean. For example, "average" salary indicates the average of salaries reported, not necessarily the salary of the "average" respondent.

'Median'

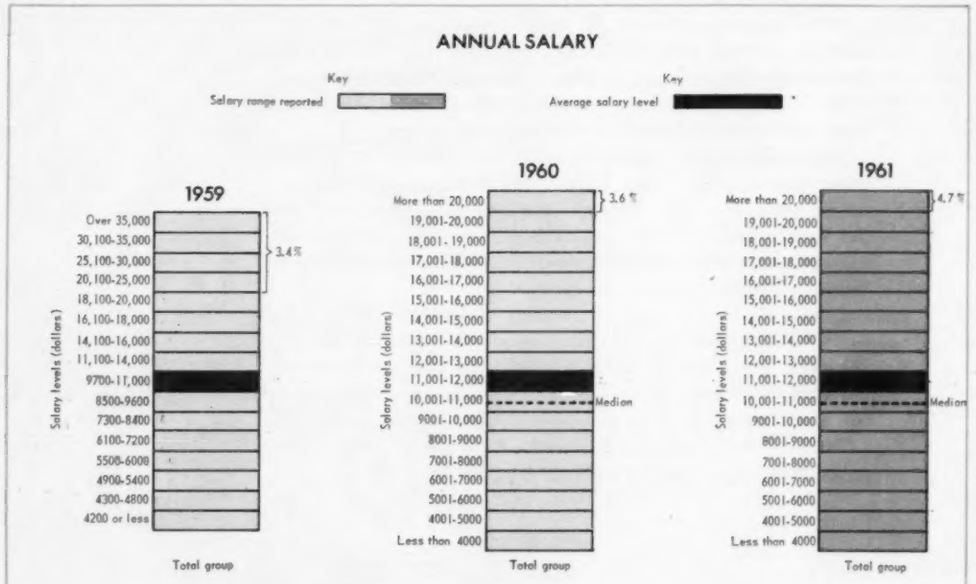
The term "median" indicates the middle term or group, chosen so that one half of the respondents are on one side, half on the other.

'Blanks'

Where respondents to a salary level total less than 1 percent of total respondents, the column has been left blank and noted with an asterisk.

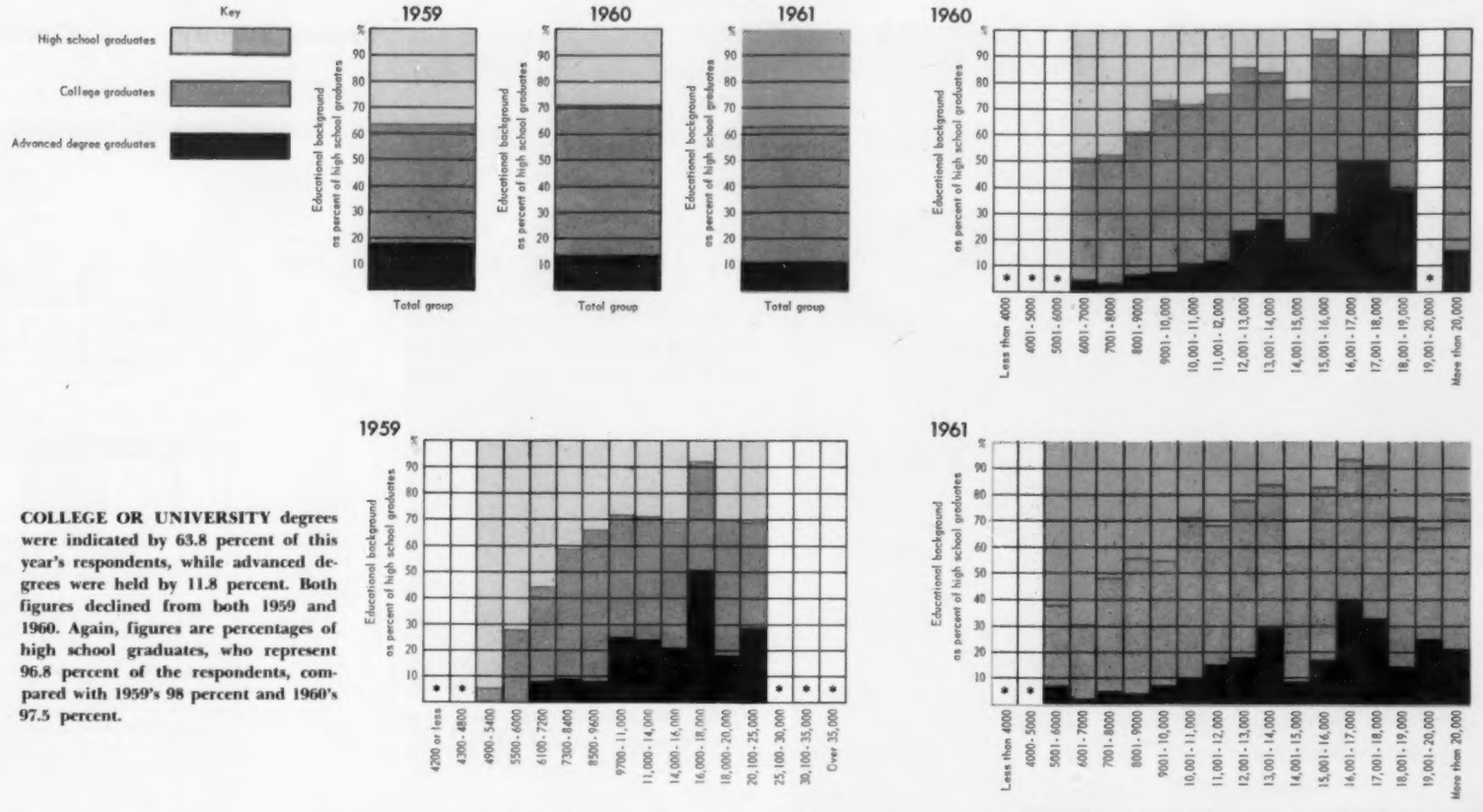


AGE, Years in Design Field and Years with Present Company remain in the same groups as for 1960. For each question, the "median" group corresponds with the "average" group.



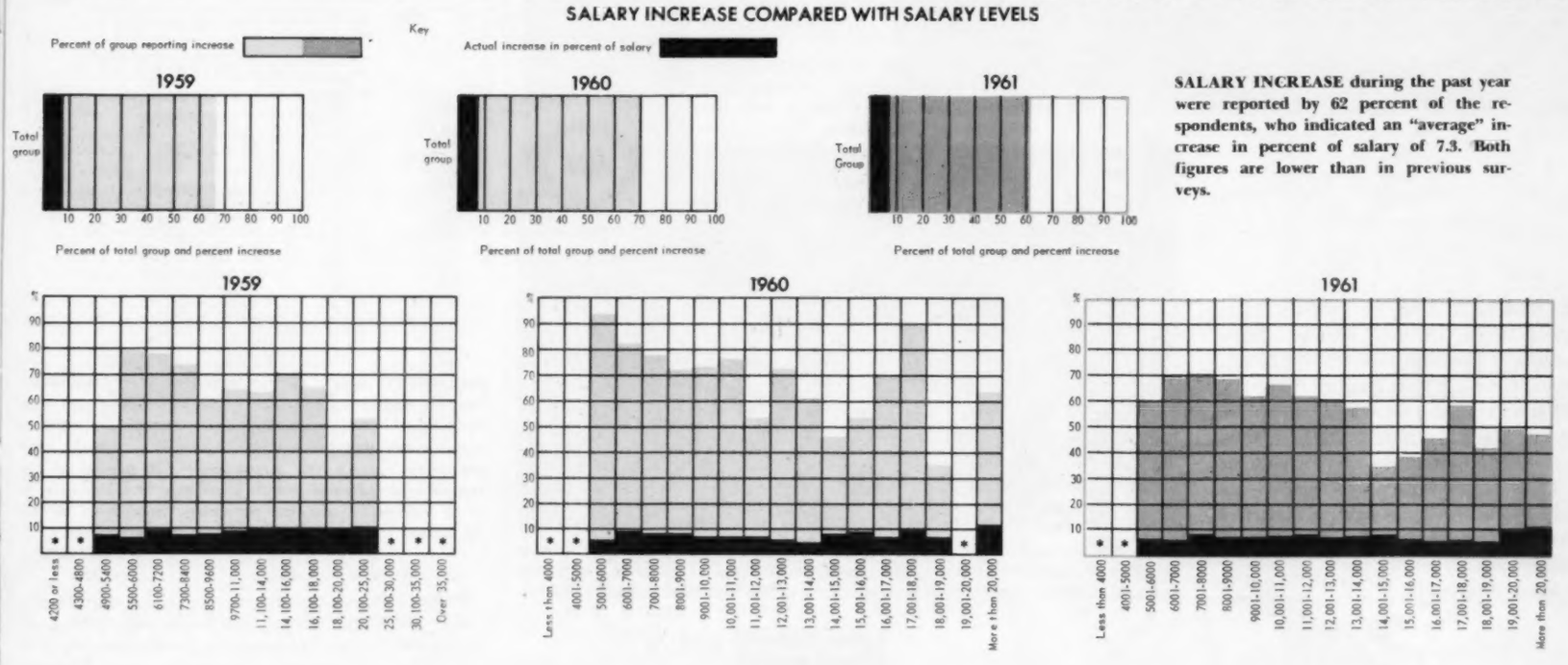
ANNUAL SALARIES covered the entire range from Less than $4000 to More than $20,000, although only one respondent indicated a salary Less than $4000. 4.7 percent of the respondents indicated salaries of More than $20,000, a higher percentage than shown in either 1959 or 1960. Both the "average" salary level and "median" remained the same as in 1960.

EDUCATION COMPARED WITH SALARY LEVELS



COLLEGE OR UNIVERSITY degrees were indicated by 63.8 percent of this year's respondents, while advanced degrees were held by 11.8 percent. Both figures declined from both 1959 and 1960. Again, figures are percentages of high school graduates, who represent 96.8 percent of the respondents, compared with 1959's 98 percent and 1960's 97.5 percent.

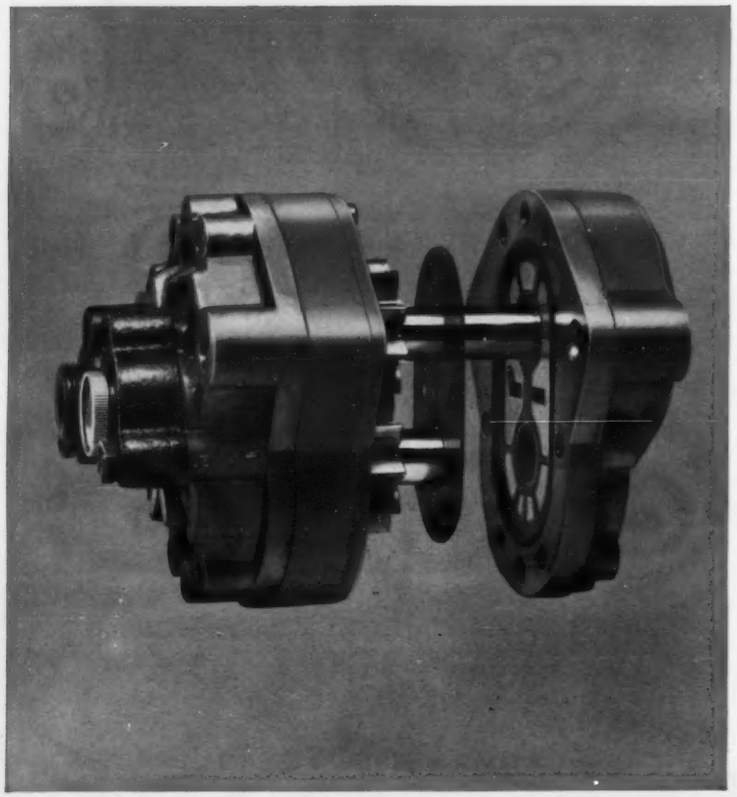
SALARY INCREASE COMPARED WITH SALARY LEVELS



SALARY INCREASE during the past year were reported by 62 percent of the respondents, who indicated an "average" increase in percent of salary of 7.3. Both figures are lower than in previous surveys.

(Continued on next page)

F-M WEAR PLATE "RIDES HERD" ON TURBULENT PRESSURE



IN CESSNA'S NEW HYDRAULIC PUMP LINE, F-M WEAR PLATE DIAPHRAGMS KEEP FLUIDS IN LINE to deliver pressures up to 2000 psi for aircraft, farm and construction equipment, many other hydraulic applications. These wear plate diaphragms maintain positive contact with gears to assure high, uniform pressure. To provide a bearing surface for this job, Federal-Mogul applies a high-density bronze to steel by a special sintering process. F-M high-density bronze prevents fluid absorption, and it affords good lubricity, needed because some hydraulic fluids are poor lubricants. To further prevent the escape of hydraulic fluid, these F-M diaphragms are manufactured for a snug, close-tolerance fit in the pump housing.

THE COMPLETE LINE of products from Federal-Mogul Division includes sleeve bearings, bushings, spacers, thrust washers, as well as wear plates. Through the years, F-M has amassed a wealth of knowledge and experience . . . from constant research, from solving bearing design problems for all kinds of products. Our engineers are ready to put this know-how to work and tailor bearing products to your requirements . . . with top performance assured.

A DESIGN GUIDE provides valuable engineering data for designers on F-M thrust washers as well as wear plates. Also available is literature on sleeve bearings, bushings and spacers. For your copies, write Federal-Mogul Division, Federal-Mogul-Bower Bearings, Inc., 11055 Shoemaker, Detroit 13, Michigan.

FEDERAL-MOGUL

sleeve bearings
bushings-spacers
thrust washers

DIVISION OF
FEDERAL-MOGUL-BOWER
BEARINGS, INC.

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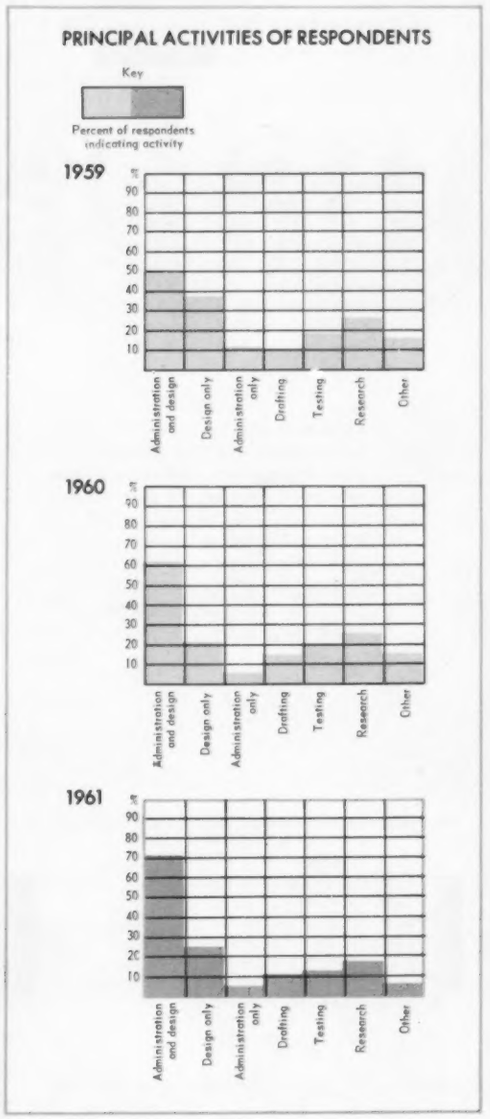
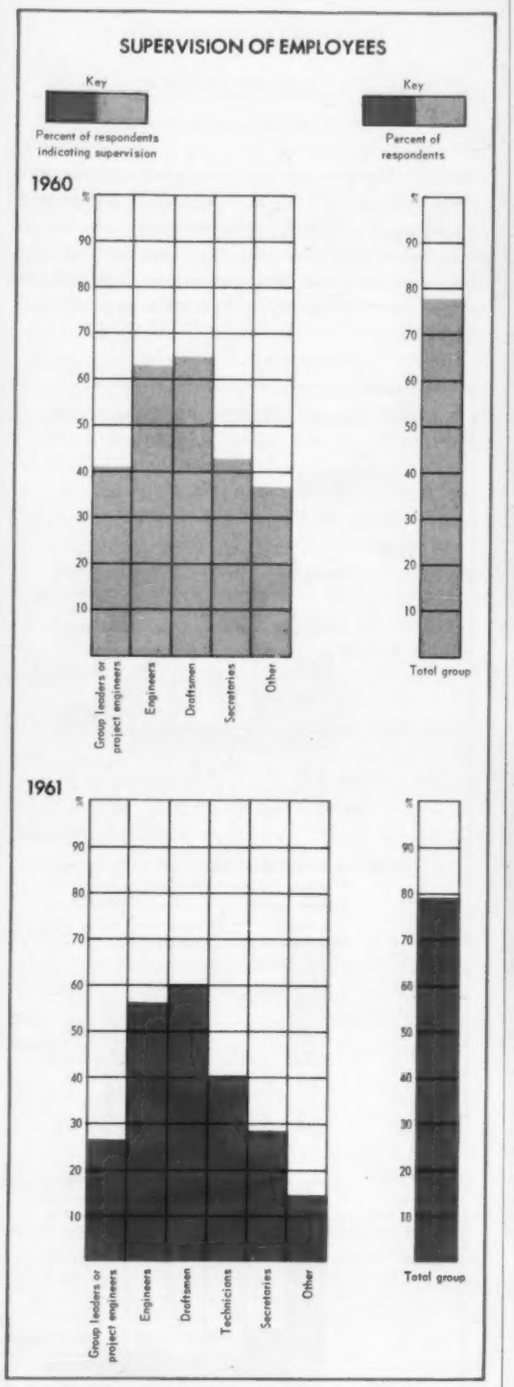
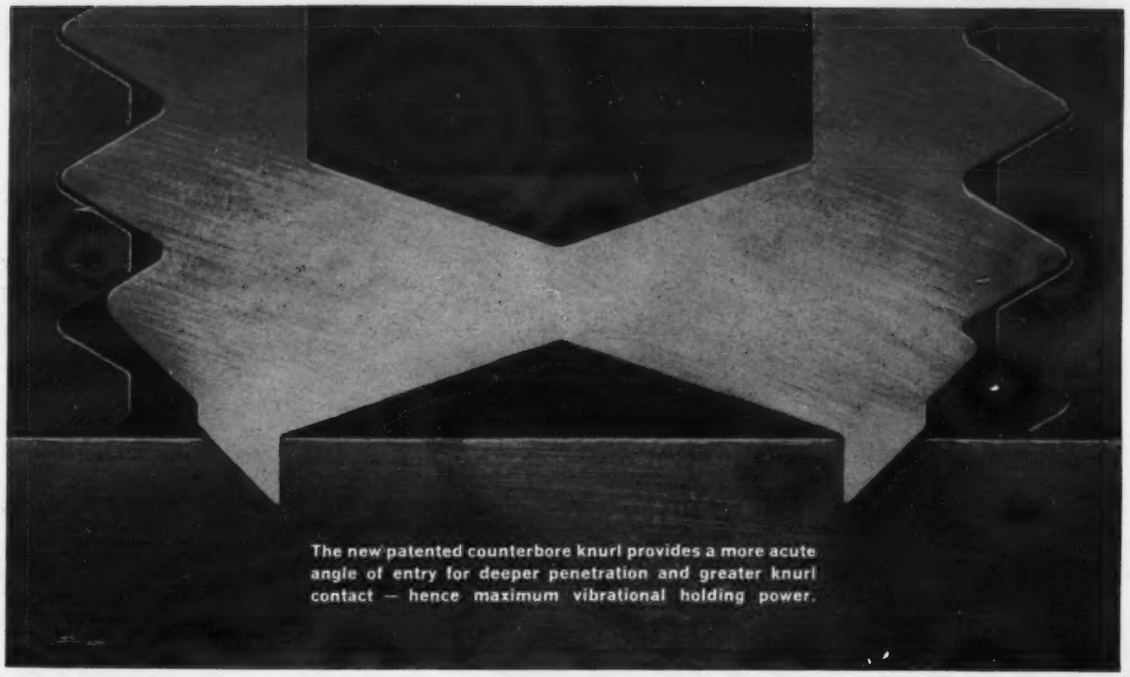


PRINCIPAL ACTIVITIES indication by respondents shows a higher percentage of those who design and who also fulfill administrative duties. Because respondents could check more than one activity if necessary, total percentage exceeds 100. Approximately 30 percent of the respondents indicated two or more principal activities. It is of interest to note the percentage breakdown of the 70 percent who indicated only one principal activity.

	Percentage
Administration and design	63.9
Design only	20.8
Administration only	5.6
Drafting	1.3
Testing	0.6
Research	4.2
Other	3.6



SUPERVISION OF EMPLOYEES was indicated by 78.9 percent of respondents, only slightly higher than 1960's 77.8 percent. Those who answered "yes" were asked to indicate which group they supervised. A new group, "Technicians", was added to this year's survey. Respondents indicated percentages shown.



The new patented counterbore knurl provides a more acute angle of entry for deeper penetration and greater knurl contact — hence maximum vibrational holding power.

NOW! Vibrational holding power hits a new high!

. . . which means that your designs can now become even more *reliable*, for the new UNBRAKO set screw with patented* counterbore knurl is "the one that won't work loose." What's more, you gain in *simplicity* (no need to use two screws since one will do the job) and in *flexibility* (no need to use a permanent pin fastening where you'd prefer a readjustable set screw).

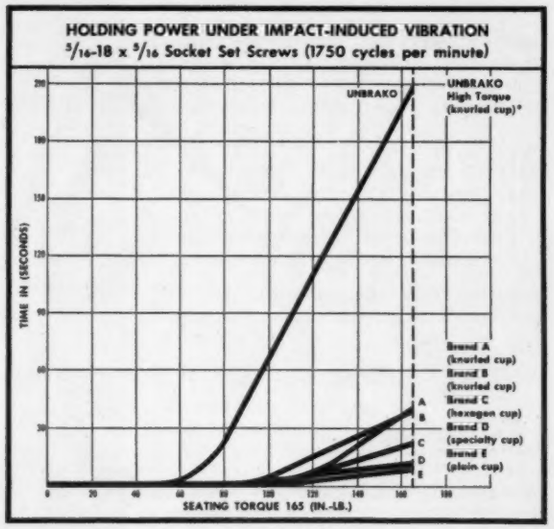
The new UNBRAKO High Torque is two ways tighter than any other socket set screw. First, the new counterbore knurl produces deeper shaft penetration. This is precisely what you need and want in order to achieve positive locking action *before* . . . and unparalleled vibrational holding power *at* the recommended seating torque.

Second, UNBRAKO's seating torques are up to 40% higher than those of ordinary set screws, and the tighter a screw is wrenched the greater its holding power. Behind UNBRAKO's higher torques:

- Exclusive Hi-Life thread root that distributes stress concentration at critical area
- Fully formed threads with metal compressed into a closely knit grain structure
- Deeper sockets for maximum key engagement and wrenching power
- Precision heat-treated steel to eliminate brittleness or decarburization

As you can see from the graph, the new UNBRAKO offers vibrational holding power no other set screw can begin to achieve—*throughout the entire torquing range.*

The new UNBRAKO High Torque Set Screw—with counterbore knurl and Hi-Life threads—is available in sizes #4 through 1 in. Your authorized UNBRAKO distributor has a complete supply on hand *now*. Where shaft penetration is undesirable, specify UNBRAKO with Nylok.† For a copy of our new booklet on UNBRAKO High Torque Set Screws, write to Standard Pressed Steel Co., INDUSTRIAL FASTENER DIVISION, SPS, JENKINTOWN 6, PENNSYLVANIA.



*No. 2,992,669—patented July 18, 1961 †T.M. Reg. U.S. Pat. Off., The Nylok Corp.

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where reliability replaces probability

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LATEST WORD FROM MARS
is the superb new Technico lead holder—with clear-view degree indicator placed right at your fingertips. Contoured for perfect balance, with new positive finger grip, it's the newest of many fine MARS drafting aids—all designed to make your work easier, and to make it look better and reproduce better.

Among the famous imported Mars drafting products are: the Mars-Technico push-button lead holders (with adjustable degree indicator*, with specific degree imprint, the economy model*); Mars-Lumograph drawing leads*, 18 degrees, EXB to 9H; Mars-Lumograph drawing pencils, 19 degrees, EXEXB to 9H; Mars-Duralar pencils and leads for drafting on Mylar® -base drafting film --5 special degrees, K1 to K5; Mars-Duralar Technicos with adjustable Duralar degree indicator; Mars-Lumochrom colored drawing pencils, 24 shades. Also: Mars Pocket-Technico for field use; Mars pencil and lead sharpeners; Mars Non-Print pencils and leads; Mars-Duralar erasers. Mars products are available at better engineering and drafting material suppliers everywhere.

®T.M. for duPONT's Polyester film. *Shown.

the pencil that's as good as it looks **MARS**
J.S. STAEDTLER, INC.
HACKENSACK NEW JERSEY

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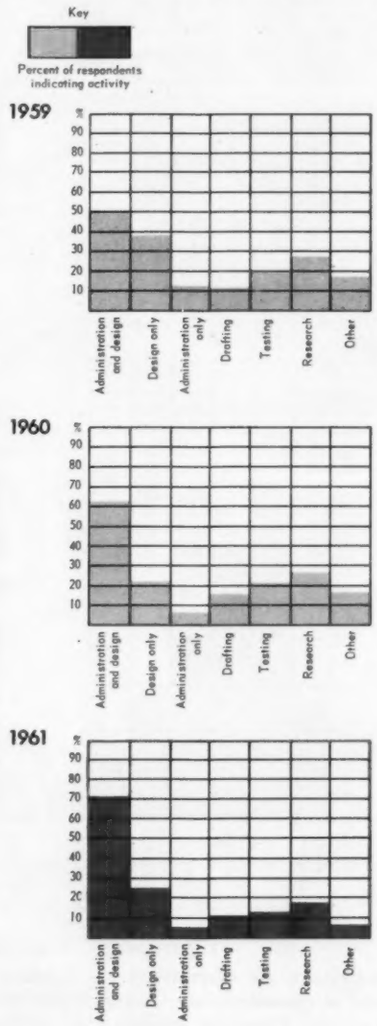
SEEN AND HEARD

PROFILE POTPOURRI

W. E. Worth, Jr., Associate Editor

For three years now we have been pointing our finger at portions of our circulation and asking engineers to reveal, anonymously, facts about themselves and their jobs. The results of our third finger-pointing are tabulated, starting on page 4 under the title, "DESIGN NEWS Salary and Status Survey".

PRINCIPAL ACTIVITIES OF RESPONDENTS



These DESIGN NEWS surveys are concerned only with the individual and his job, on the job. We don't ask his standing in the company bowling league, how many children he has or even if he is happy or unhappy in his job.

The results of these surveys are not only interesting but also intriguing. It would seem that after three surveys some trends or indications of trends would be appearing. We have detected a few areas where there appear to be changes. Each year we have asked our respondents to indicate their principal activities. Realizing that some respondents have responsibility in more than one activity, respondents were free to check more than one, if necessary.

Comparing the three graphs, it appears that engineers with some degree of administrative responsibility are on the increase. If this is a trend, it is an encouraging trend. It means that engineers are being called upon to handle administrative and management functions. When the individual is called upon to assume these responsibilities, he needs preparation. Management functions require more than the simple logic—which scientific and engineering training is supposed to develop.

Also of interest on the graphs is the drop of over five percent in the research category. Does this mean less product research is being carried out? And what about the decrease in testing?

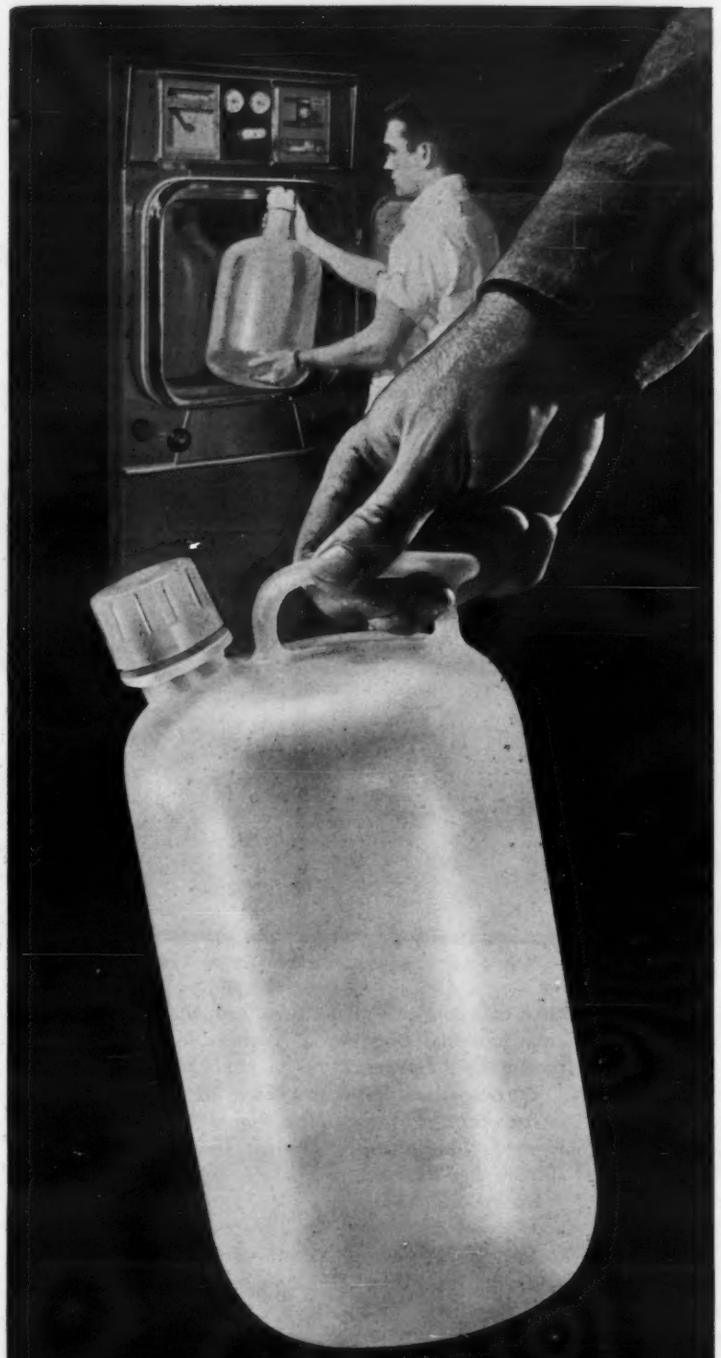
You may be interested in some figures which are not incorporated in the Special Report. Respondents were asked to indicate which of five functions best described their job. They indicated the following:

Corporate Management.....	7 percent
Engineering Management.....	24 percent
Engineering and Design.....	66 percent
Technical Assistance.....	2.5 percent
Corporate Assistance.....	0.5 percent

You may be interested in a few questions that are not tabulated in the Special Report. In response to a question, "Is your work primarily mechanical design or primarily electrical design?", the respondents indicated the following:

Primarily mechanical design.....	86.5 percent
Primarily electrical design.....	13.5 percent

When asked if they specialize in designing a certain portion of their engineering department's end product, 45.8 percent said "Yes", 54.2 percent said "No".



Five-gallon standard solution bottle and gallon jug with handle are examples of laboratory ware blow-molded by The Nalge Co., Inc., Rochester, N.Y.

they're better
...cost less
blow-molded of
AVISUN
polypropylene

From laboratory ware to picnic jug liners, AviSun polypropylene is finding many applications in fields long limited to glass.

1 HIGH HEAT RESISTANCE. Polypropylene blow-molded containers can be repeatedly sterilized with boiling water or autoclaved with live steam.

2 TOUGHNESS. Strongest and lightest of all thermoplastics, polypropylene bottles survive drops and hard knocks without cracking or shattering. Lightweight polypropylene vessels are easier to handle, unlikely to slip when wet. Threads for caps aren't damaged by overtightening.

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4 ECONOMY. Lightweight, low-cost polypropylene is readily blow-molded, gives more bottles per pound of resin, lower packaging and shipping costs, for true economy in the final product.

The same advantages that make polypropylene valuable for these large containers can work for you in your product. Call on AviSun for complete polypropylene specifications and expert technical assistance.

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Please send full information on blow-molding grades of AviSun polypropylene.

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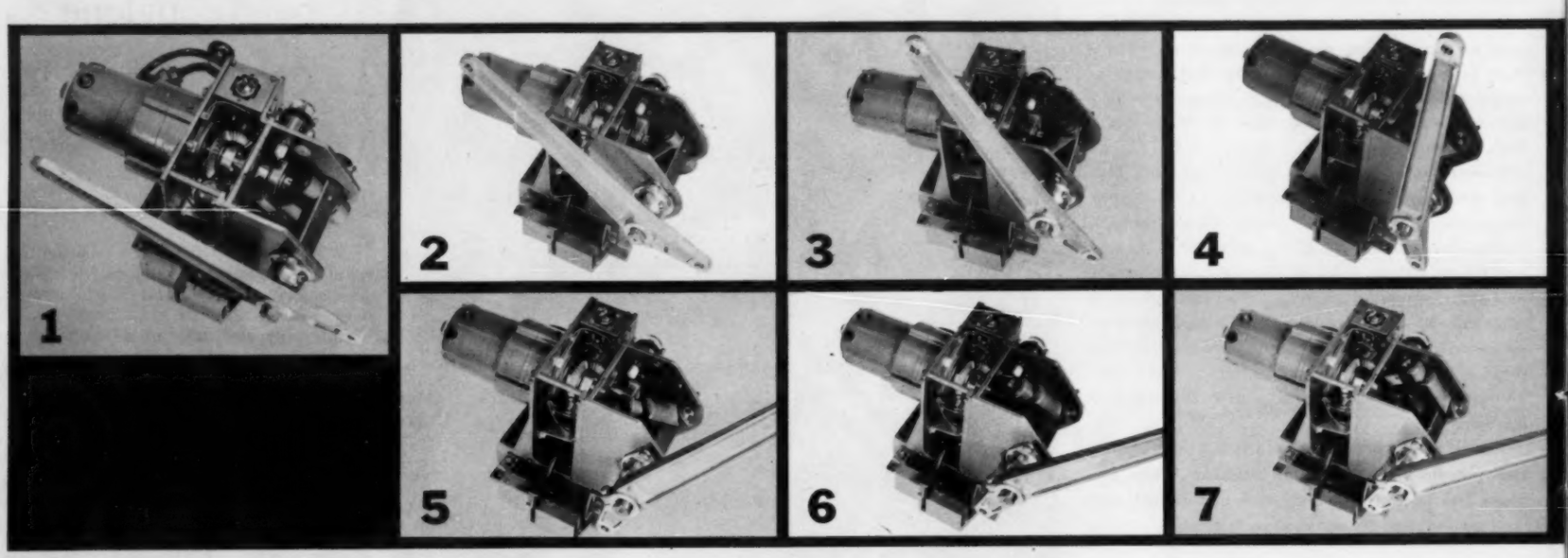
Mechanical Linkage Moves Car Door with Harmonic Motion

Lars G. Soderholm, Midwest Editor



An electric door operator, designed for use in electric transit cars, uses two articulating yoke linkages to change constant-velocity, circular motion to harmonic motion. Another set of linkages transmits this motion to the car doors during their opening and closing cycles.

Automatic door opening and closing are very important in any transit vehicle. Harmonic motion is desirable because it provides a gradual start, a high-speed center of travel and a gradual slowdown to final door position. This reduces the danger of "clamping" passengers or their possessions. Because of gradual acceleration, it also provides the least wear and tear on door operator components.

The operator uses a compound-type motor selected for good speed stability and regulation. Speed can be controlled by a simple shunt field resistor without appreciable loss in efficiency.

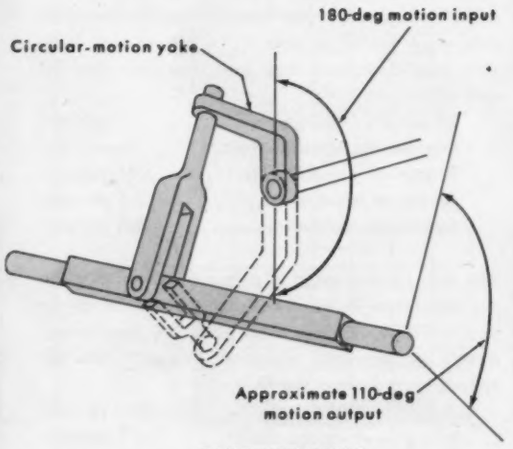
The operator motor drives the door through a gear reducer set that turns a circular-motion yoke 180 deg in each direction as the door opens and closes. The circular-motion yoke is linked to another yoke that connects to the drive arm shaft. The circular motion of one yoke is translated into harmonic motion by the other.

To overcome inertia and bring all moving parts of the operator to a complete stop, dynamic braking is used. This protects operator components from sudden impacts inherent in mechanical stopping.

Doors stay locked because of mechanical cam action. An emergency handle permits the linkage to be cranked past its center position, after which doors can be pushed open by hand. Additional safety devices such as interlock relays and door lock mechanisms also are provided.

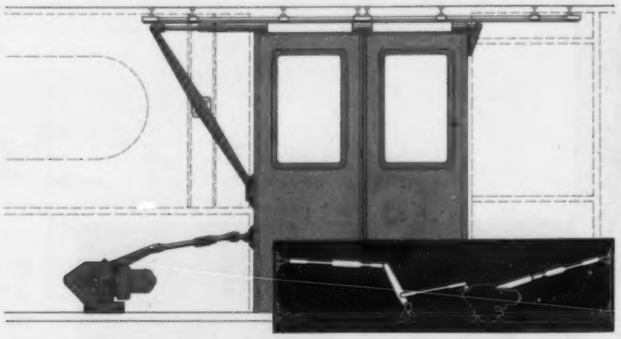
The electric door operator is made for mounting under a car seat. A typical operating cycle would be 1-1/2-sec opening time and 2-1/2-sec closing time. However, this can be adjusted to fit the application. All switch operation occurs when doors are either fully open or closed. This eliminates the possibility of contact arcing during a door jam.

The electric door operator is made by the Vapor Heating Corp., Niles, Ill.

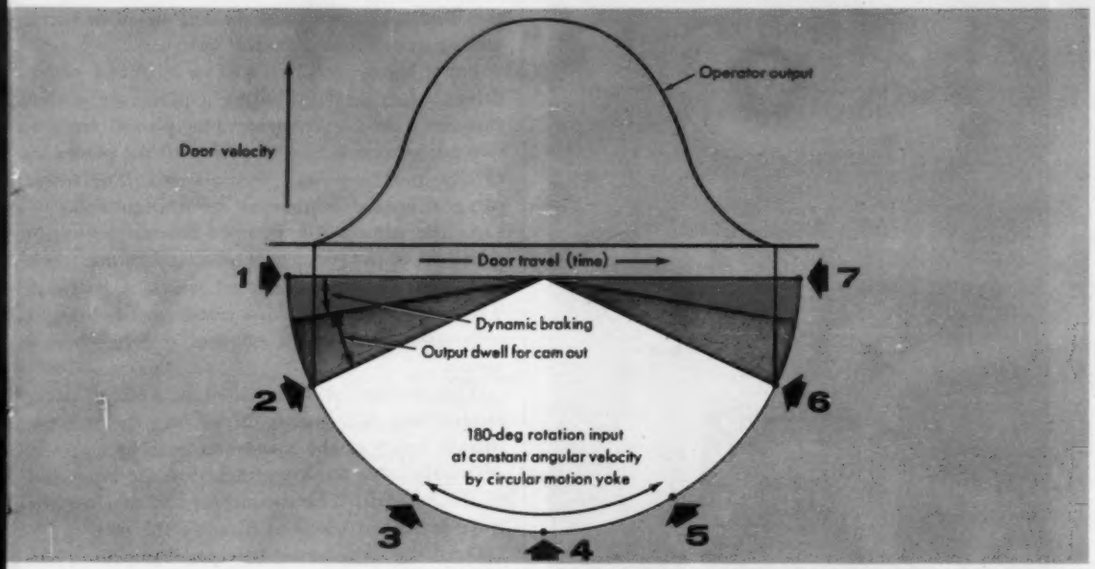


BASIC MECHANISM

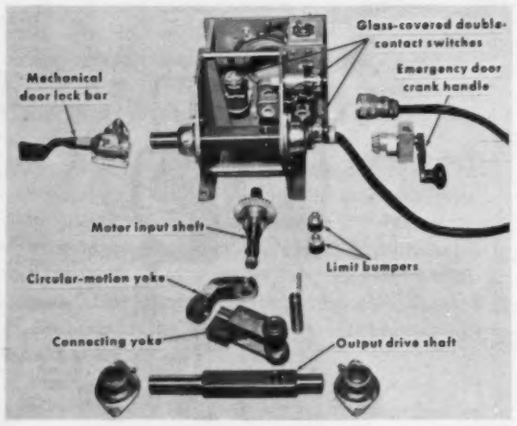
BASIC MECHANISM uses circular-motion yoke that makes 180-deg movement for every open or close cycle of car doors. Connecting yoke transmits this movement to drive shaft and drive arm. Arrangement of components provides 110-deg output motion.

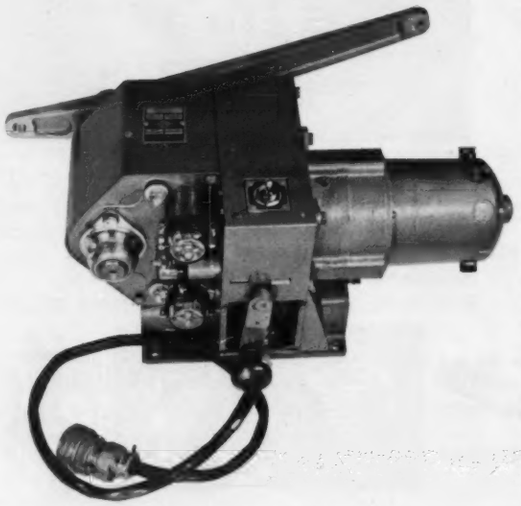


OPERATING POSITIONS of electric car-door operator and linkages used to secure siumultaneous motion of two doors.



VELOCITY-TIME CURVE for operator output is plotted beside input of circular-motion yoke.





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On Gas and Liquid

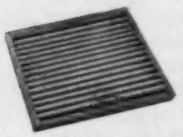
FILTRATION PROBLEMS

Consult

AIR-MAZE

THE FILTER ENGINEERS

Keeping equipment moving longer, smoother, more efficiently by keeping it free from damaging liquid or gaseous contaminants has been the specialized province of Air-Maze engineers for 35 years. Shown below are a few of the wide variety of products developed by Air-Maze to meet the increasing demands of design engineers.



AIR FILTER PANELS – Many different types to meet government or your specifications. Permanent, all metal mesh, also dry washable media as illustrated. For all ventilating applications including electronic cabinets. Bulletin 372

FILTER-SILENCERS – Reduce intake air noise of blowers, engines or compressors with efficient acoustical chamber combined with air filter of oil bath, oil-wetted, or dry cleanable media. Sizes from 5 to 6500 CFM. Bulletins 515 and 565

LIQUID FILTERS – Positive filtration from 10 to 100 microns with extended area (disc or pleated type). All metal (stainless, monel, bronze) cleanable media in closed circuit or designed to fit your cavity. With or without relief valve or thermal lock-out. Bulletin 800

BREATHER FILTERS – Vented gear cases, crank cases, hydraulic equipment, storage tanks and machinery housings are protected against dirt and dust with Air-Maze all metal, cleanable, oil-wetted or oil bath type breathers. Available with or without weather hoods. Bulletin 700

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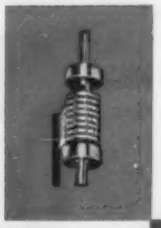

SIMPLE
TO
SUPER

BREEZE SLIP RINGS MEET UTMOST PRECISION STANDARDS

When you specify Breeze slip rings, you start with these advantages: you may order custom assemblies built to the most exacting standards, or effect real economies by choosing from Breeze-engineered stock items if they suit your applications. Both kinds can be depended upon for the utmost in precision and performance. As for size, Breeze offers a wide range, from small 2-ring assemblies to 500-ring giants.

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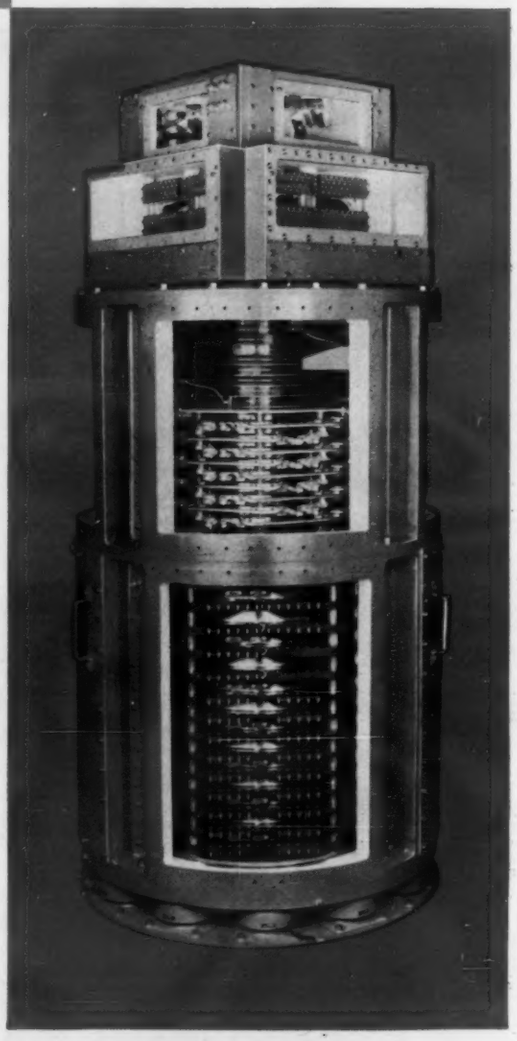
Write for detailed literature.



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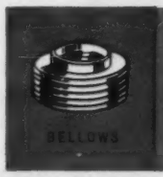

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Resilient Roll Acts

R. F. Stengel, German Editor

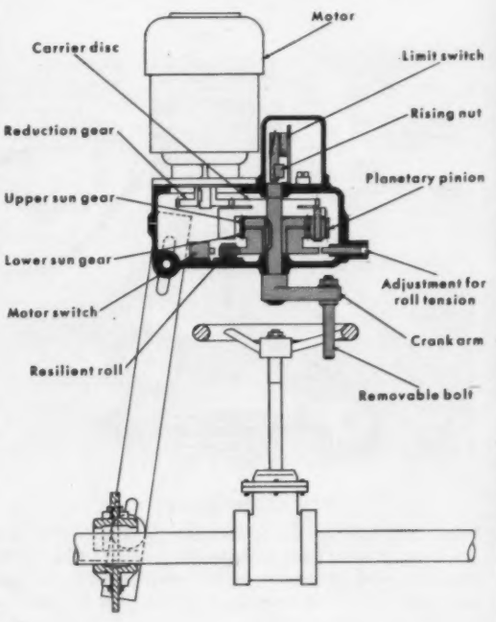
In a unit for remote-control closing and opening of valves, a resilient roll acts as torque overload clutch. During closing, the roll engages a notch in a stationary sun gear. Once the valve is fully seated, its resistance tries to turn the sun gear; this automatically rotates the roll out of its notch and against a motor shutoff switch.

Power is provided by a 0.01-kw a-c motor which drives a carrier disc holding a planetary pinion through a reduction gear. The pinion engages two sun gears mounted coaxial with the planetary carrier and differing by one tooth. The lower sun gear is held in place by the resilient roll.

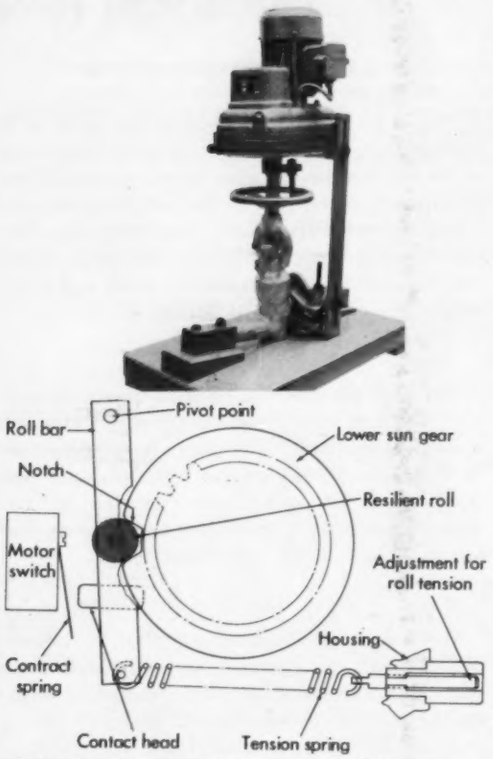
As the pinion rotates once around both sun gears, the upper sun gear is advanced by one tooth and turns the main shaft on which it is fitted. The shaft terminates in a crank arm holding a removable bolt which engages the handwheel spokes.

The circular roll is mounted on a bar pivoting around one end, and is forced into the trapeze-shaped notch of the lower sun gear by a spring with adjustable tension attached to the other end of the roll bar. The torque needed to close the valve is not sufficient to dislodge the roll.

Once the valve seats, however, the pinion can



as Torque Overload Clutch



HORIZONTAL SECTION in plane of resilient roll.

no longer turn the upper sun gear and the main shaft. The motor now overcomes the resistance of the tension spring and turns the lower sun gear. The roll is forced out of its notch, and a contact head on the roll bar closes the motor shut-off switch.

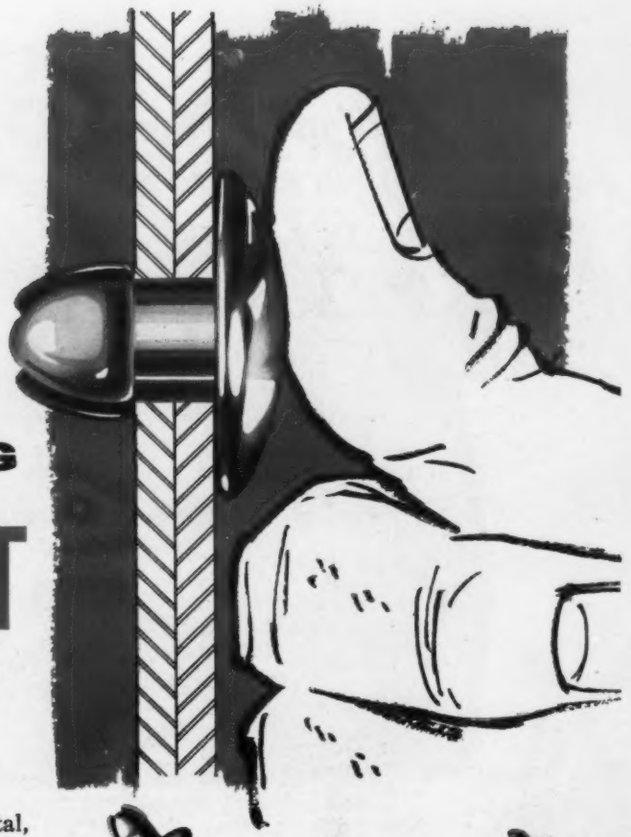
For valve opening, the motor is reversed. The lower sun gear rotates in opposite direction until the roll again seats in the notch.

The opposite end of the main shaft carries a nut constrained to move axially on a steep-pitch thread. After the nut has risen through a distance equivalent to the valve lift, it touches a limit switch, shutting off the motor.

The device provides 21.5 lb-ft torque at 10 rpm, with up to 20 turns per cycle. Maintenance is minimal, as the main shaft runs on sintered bronze bearings and the ball bearings are lubricated by "Molykote BR 2".

The torque drive DMK 1 is manufactured by Koenig & Bauer AG, Moedling near Vienna, Austria.

to fasten
panels
or parts . . .



LIGHT, STRONG

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Studs can be designed in steel or brass with various flange configurations for clinch, clip or clamp attachment to flexible or rigid panels as well as for push-through assembly. Available in all standard finishes . . . with or without decorative caps.

Push Rivet Stud Shoulder Type (Capped)
Push Rivet Stud Tapered Type (Capped)
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Push Rivet Stud Tapered Type (Not Capped)
Clinch Type Stud
Clip-on Stud
Trim Stud Barrel Type
Trim Stud Scissors Type
Panel Type Stud
Loop Type Stud
Panel Stud Staple Type
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► *For further details, write for Engineering Data Catalog, Section H*

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Separating Force

E. J. Stefanides, Central States Editor

A ring of pivoted dogs is used in the chuck of a post-inflation tire machine to prevent separation of the tire rim plates (rim halves) by the 75-psi air pressure in the tire. In this machine, the tire is held between a fixed and a removable rim plate while cooling in an over-inflated condition. Over-inflated cooling stretches the tire cords and minimizes their shrinkage after curing.

The dogs are mounted on individual pins and are located in slots about the periphery of a circular hub attached to the upper fixed rim plate. In the engaged position, this hub fits down into the ID of the removable lower rim plate and the dogs are extended so their outer ends bear against a ring within the ID of the lower plate.

When the tire is inflated, a limited movement of the lower plate rotates the dogs until their inner ends are solid against the upper plate, forming a positive-lock mechanical structure which prevents further separation. Since the chuck is positively locked by the air pressure, it is impossible to remove the tire or separate the plates accidentally until the pressure is exhausted.

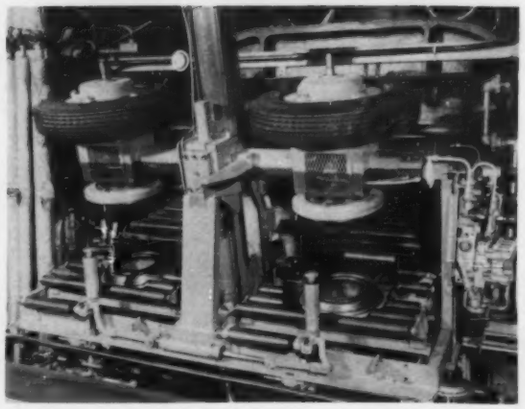
When the pressure within the tire has been exhausted, the chuck may be disengaged easily by two small air cylinders. One cylinder lifts the lower plate to permit the other cylinder to rotate and retract the outer ends of the dog.

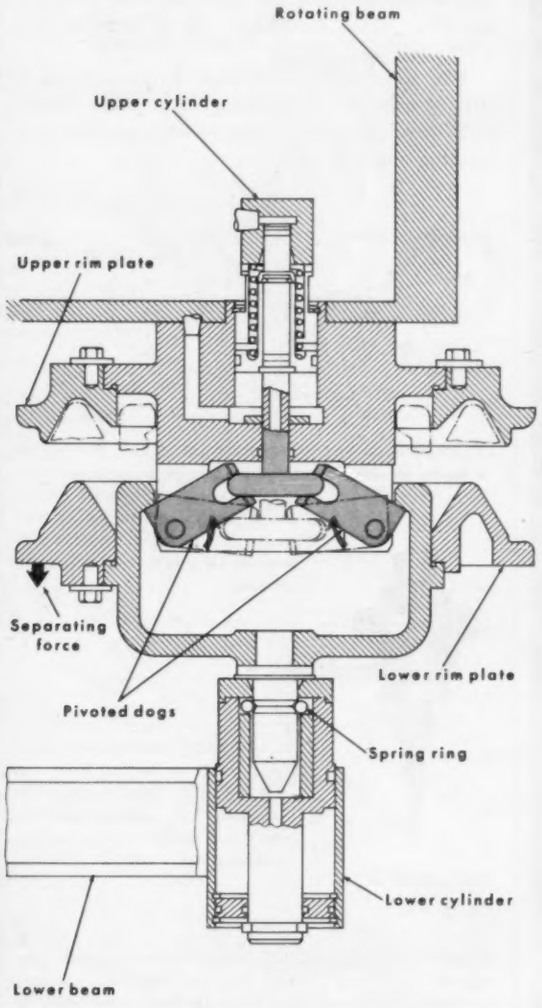
Four of these chucks are used in the machine. They are attached in pairs on each end of a rotating beam or shaft. This arrangement provides two post-inflation cooling stations for each mold and allows the cooling period to be longer than the curing period. The entire machine is actuated automatically by an interlocked and controlled pneumatic system.

The machine was designed and manufactured by the Firwood Mfg. Co., Inc., Dearborn, Mich.

Locks Tire Rim Plates

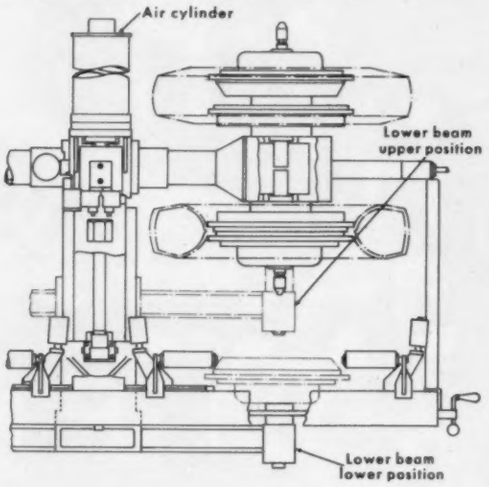
POST INFLATION MACHINE is located adjacent to two-mold tire press. Inclined roller conveyor carries tires to table of machine where they are automatically lifted and installed on chucks for cooling. Rotating beam on which chucks are mounted is driven through gear and rack by pneumatic cylinder.





CHUCK is shown in engaged position. Over-travel of lower plate is required to seat lower tire bead. After seating, tire is removed and lower arm cylinder retracted. Beam on which chucks are mounted then may be rotated as required to provide proper cooling period. After cooling, internal tire pressure is exhausted and lower cylinder arm comes up to retrieve tire and removable rim plate. Plate is lifted again to initial over-travel position, causing spring ring to latch lower plate to lower cylinder piston. Upper cylinder then is actuated to retract dogs and disengage chuck and lower beam is lowered to remove tire. During cooling, chuck locks retainer plates against 185,000-lb separating force developed by 75-psi tire pressure acting on 28-inch-dia area of tire.

LOWER BEAM is shown by dotted lines raised in over-travel position as when installing or retrieving tire from chuck. Raising and lowering of beam is done by actuating large-diameter air cylinder. When arm is lowered, tire is automatically stripped from lower rim plate as it goes through table opening.



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Mr. Design Engineer

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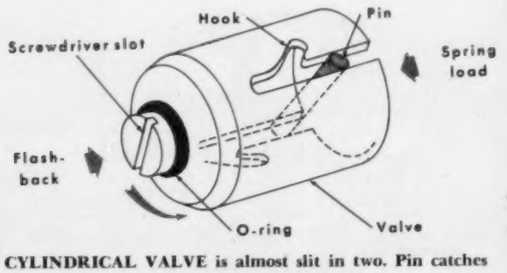
Flame Flash-Back Releases

Volrath Holmboe, Correspondent in Sweden

Shock loads from flash-back during gas welding simultaneously compress and rotate a spring-loaded valve which operates like a pin catch. Rotation forced by the hooks releases the valve from the pin, permitting the spring to press the valve against its seat. The arrangement stops outgoing gas flow, which eliminates risk of external fire after flash-back.

The valve, designated Elga Triplex, forms a part of a flash-back arrester designed by AB El and Gassvetsning, Goteborg, Sweden, for acetylene welding and cutting.

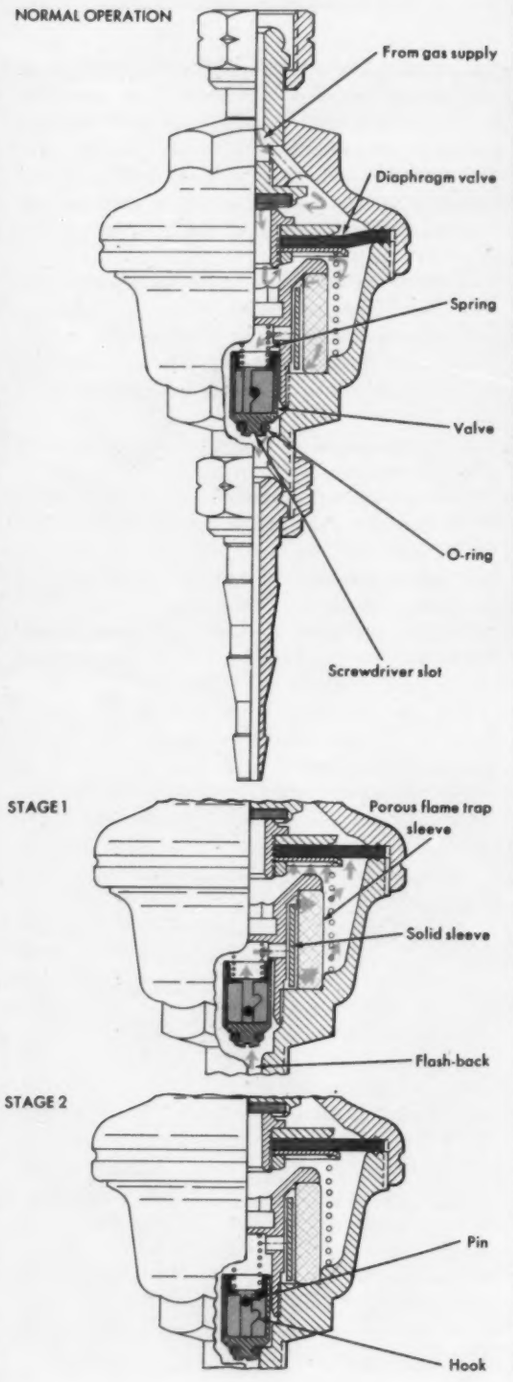


CYLINDRICAL VALVE is almost slit in two. Pin catches in hooks on side of slits. Arrangement permits valve to move in only one direction, rotated by hooks. Valve rotation releases hooks from lock pin, which in turn permits valve to move in other direction.

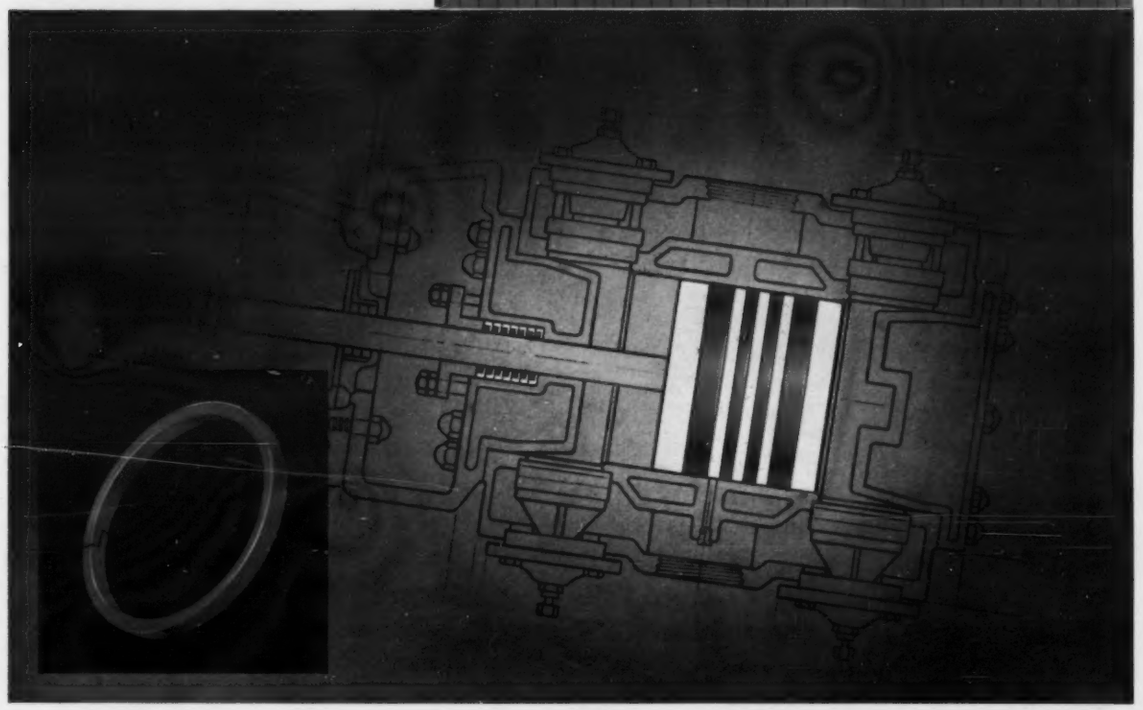
FLASH-BACK ARRESTER is located close to outlet from gas supply. Object is partly to prevent flash-back from entering gas container and partly to eliminate external fire risk.

FLASH-BACK ARRESTER: Complicated labyrinth passage for gas during normal operation facilitates efficient two-stage function at flash-back. In first stage, valve is released, flame trap sleeve of porous sintered stainless steel absorbs flash-back and diaphragm valve is closed by pressure wave to stop further penetration. Large diaphragm insures quick closing. In second stage, valve is closed to stop outgoing gas flow. O-ring seals valve against seat. After flash-back, valve is opened by screwdriver pressed against valve and turned to bring valve back into locked position.

Lock, Stops Gas Flow



DU PONT TEFLON®



How piston rings of TEFLON® saved $1,600 per year in compressor maintenance alone

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- Rings of TEFLON can permit bone-dry operation . . . provide more uniform output because there is less gas blow-by . . . reduce danger of fretting, galling and cylinder wear.
- Rings of TEFLON are not brittle . . . resist chipping, cracking, breaking . . . installation, storage and handling are easier.
- Rings of TEFLON make possible substantial savings in operating, maintenance and replacement costs.

In a plant manufacturing chemical intermediates, a two-stage compressor handled ethyl chloride. In this service, standard carbon piston rings required constant lubrication and maintenance during their average life of 2,000 hours. Conversion of this unit to piston rings of a TEFLON TFE resin had dramatic results. These rings operated for 10,000 hours without maintenance. Lubrication and product contamination were eliminated. On this one compressor, the plant saved $1,600 in maintenance costs alone.

Such savings and improvements are typical of those provided by rings of TEFLON. If you are buying a new compressor, specify rings and packings of TEFLON. To convert your present equipment, check with your compressor manufacturer or qualified ring supplier for engineering and design assistance. For further information, write: E. I. du Pont de Nemours & Co. (Inc.), Dept. DN-11-T, Room 2526, Wilmington 98, Del. *In Canada*: Du Pont of Canada Limited, Box 660, Montreal, Que.

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TEFLON is Du Pont's registered trademark for its family of fluorocarbon resins, including TFE (tetrafluoroethylene) resins and FEP (fluorinated ethylene propylene) resins.

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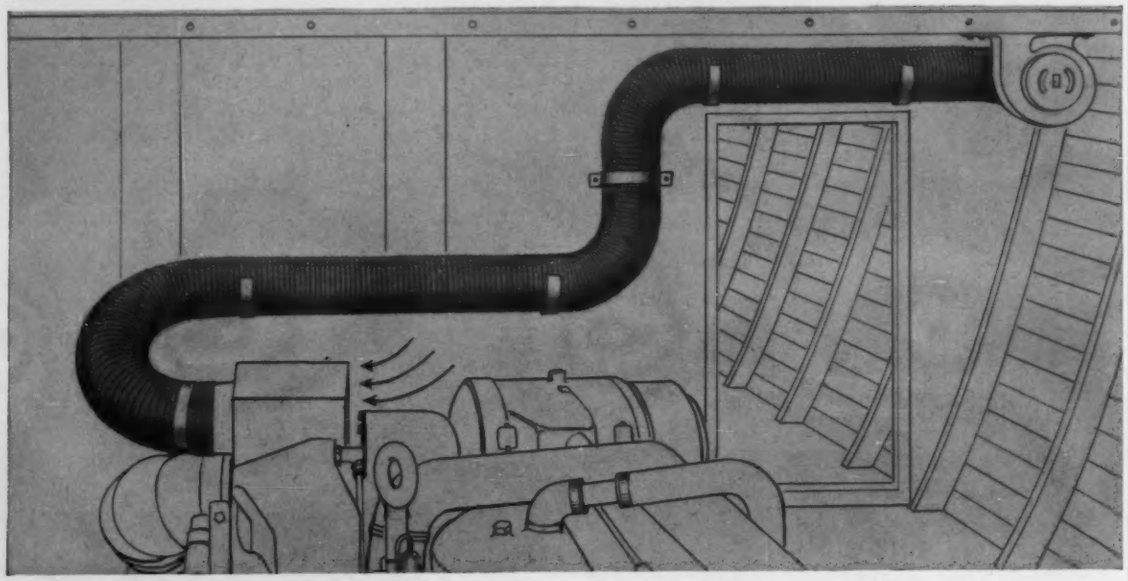

Aboard Chris-Craft's new 55-ft. "Constellation", Flexible Tubing solves the problem of how to vent engine supercharger . . .

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Power Hose Reel

Lars G. Soderholm, Midwest Editor

An electric-powered, heavy-duty industrial hose reel makes use of a horizontal hose container mounted on a vertical spindle to allow natural coiling of the hose. Both hose pay-out and take-up are controlled through three belt-connected contoured drive rollers which, with their mating tensioned idler rollers, hold the hose securely in the roller assembly.

Designed to overcome problems encountered with winch-type power reels, this vertical-spindle hose reel eliminates kinking problems that reduce the life of tightly wound hose. The new reel also overcomes the necessity of compensating for axial loads.

The hose in the vertical-spindle reel always is gripped in the rollers of the roller assembly. Three contoured drive rollers are connected by a single belt that runs in the bottom of their contoured sections. The hose itself rides on the belt as it passes over the three drive rollers. To keep the hose in position, three spring-tensioned idler rollers are provided, one for each drive roller. Spring tension is adjusted to insure that the hose can be held firmly by the rollers.

The hose container is not powered, but turns freely as the hose is reeled in or out by the powered roller assembly. As hose is reeled in, it is directed toward the outside edge of the container where it falls naturally into a loose coil.

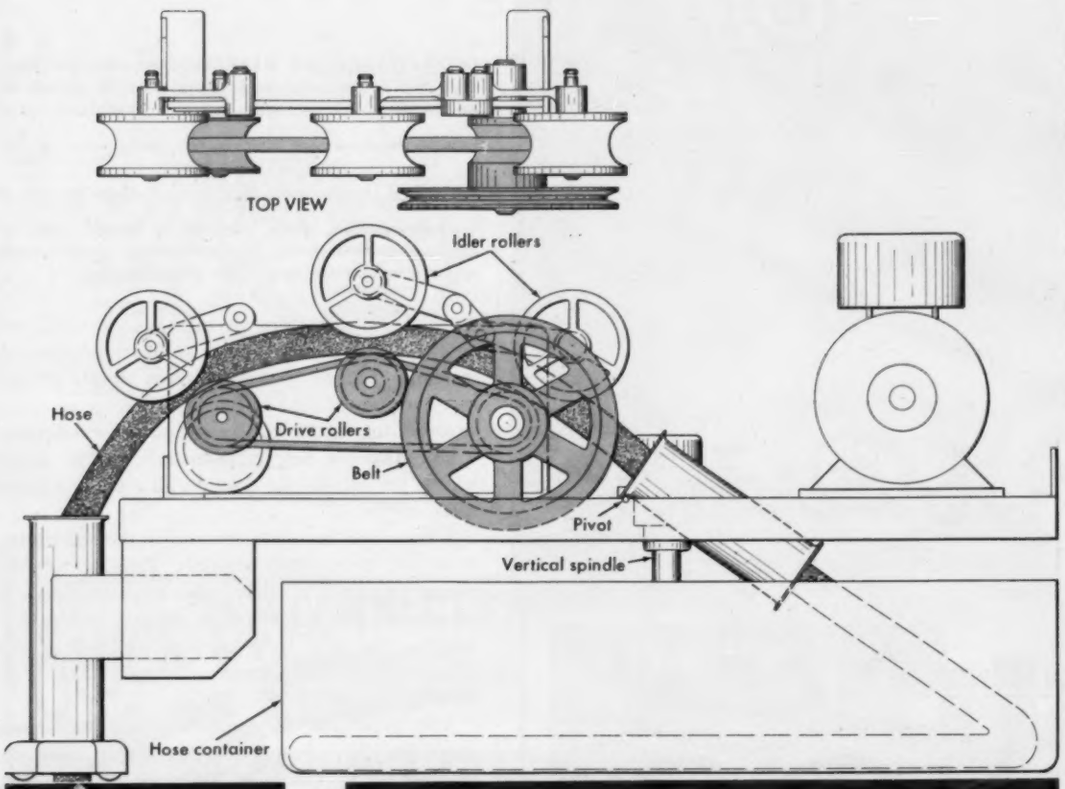
To prevent a hose pileup if the hose were to climb the outside edge of the reel, the guide tube is pivoted and attached to a miniature electrical switch. If the guide tube lifts too high, the motor driving the roller assembly is reversed. This causes the hose to be pulled momentarily toward the center of the reel where it falls to the bottom of the container.

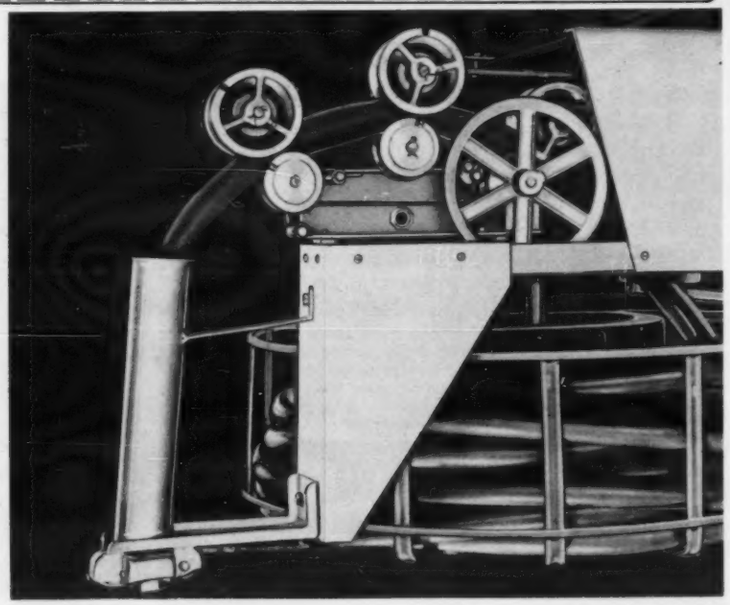
Hose stops can be provided by attaching electrical switches to the tension rollers where they sense builtup sections of the hose.

The vertical-spindle power-operated hose reel is operated by a 1/2-hp electric motor remotely controlled by a pendant-type control or any other means. Containers can be provided up to 42 inches in dia to hold 50 to 500 ft of industrial hose up to 1-3/4-inch-dia size. Hose take-up and let-out rates are 100 fpm or better.

The Zierco electric-powered hose reel is manufactured by the Zierden Co., Milwaukee, Wis.

Uses Vertical Spindle, Gravity Coiling System





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CASE HISTORY 768

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Thermolab element on bearing retainer of Jax turbine.

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BIG NEWS
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Diagonal Disc between

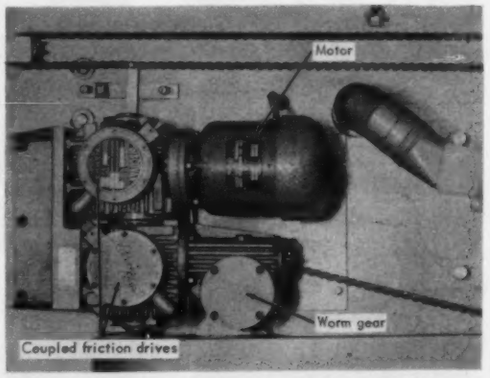
Celestino O. Lubatti, Italian Editor

INTERCHANGEABLE BEARINGS are used for drive shaft and downward-facing pressure wheel to permit in-line (as shown) or right-angle arrangement of drive. Speed ratio between driving and driven shafts $\frac{n_1}{n_2} = K\frac{r_a}{r_b}$, where K is constant ratio of radii $\frac{r_2}{r_1}$ (relative to sizes of friction wheels), r_a and r_b are radii of contact circles on diagonal disc. Belleville or coil springs press wheels against diagonal disc to produce proper friction.

A sliding diagonal disc permits stepless variation of speed ratio in the lamp drive of a blueprinting machine. The driving and driven wheels are located either in line or at right angles to meet space requirements without modification of parts. Elimination of belt transmission and/or large wheels permits simple design and relatively large speed range.

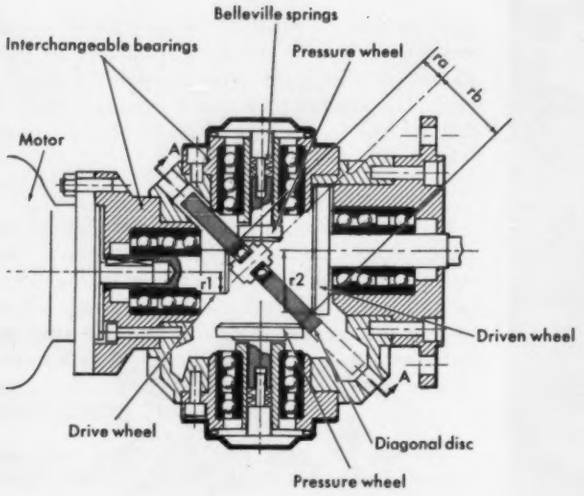
A fractional-horsepower motor is flanged directly to the drive-wheel support. Pressure wheels, perpendicular to the drive axis, keep the diagonal disc in friction contact with driving and driven wheels. The shift fork carrying the hub of the diagonal disc is on a screw-actuated, sliding shaft which sets speed ratio.

The drive can be combined with step-down gears for further speed reduction. It was developed by G. Oboni of Ditta G. Fiamma Sas, Turin, Italy.

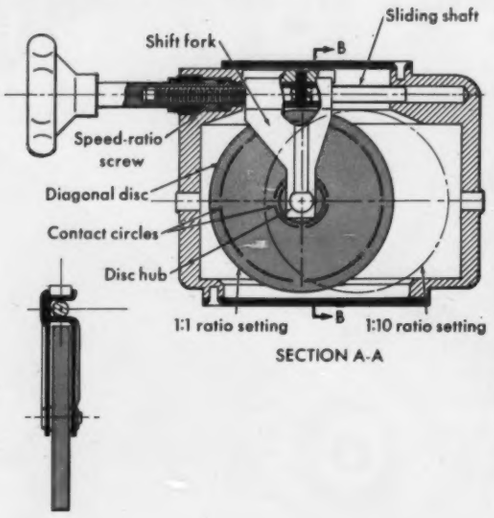


BLUEPRINTING MACHINE uses two right-angle friction units permitting continuous speed variation of lamp drive between 1400 rpm (motor speed) and 17.5 rpm. Worm gearing further reduces speed range to 70-0.9 rpm to provide slow movement for paper-feed rollers. Variable drive, trade-named "Discovar", uses 0.25-hp electric motor.

Friction Wheels Forms Infinitely Variable Drive



SECTION B-B



SECTION A-A

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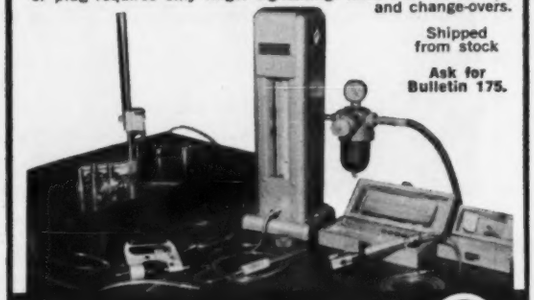

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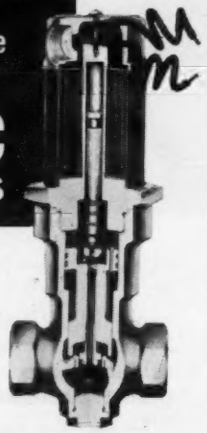

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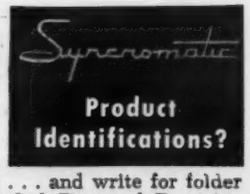
What are your zinc or aluminum *die casting needs...*



ADVANCE know-how in Zinc and Aluminum die casting design, engineering and production covers a wide range of component part needs from small camera parts. . .

. . to engine cylinders

Moreover, ADVANCE often solves a product sales problem by alert die casting engineering and skills which smooth-up product lines and appearance while at the same time improving casting cycles and lowering part costs.

That is why ADVANCE Zinc and Aluminum die cast parts are important components everywhere in home appliances, office equipment, power tools, gas engines, cameras, surveyors' instruments, electric motors and control devices.

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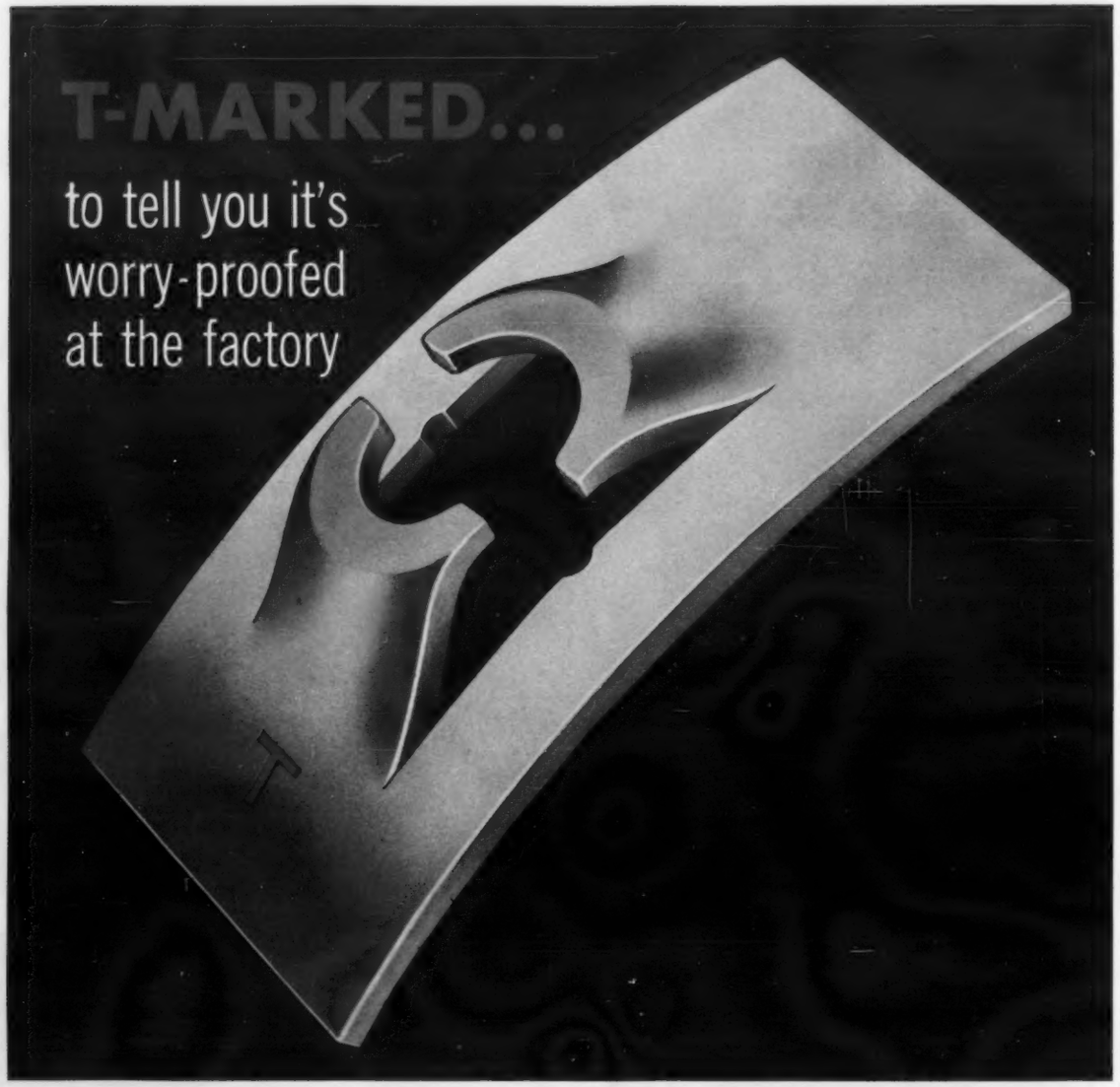

Other spring fasteners may look like Tinnerman SPEED NUTS. But only the *T-marked* ones really are SPEED NUTS . . . really are "Tinnermans". . . made to highest quality and precision standards to assure worry-proof performance on your assembly.

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Over thirty-five years of Tinnerman experience as the originator and largest producer of spring-steel fasteners...the leader in solving your fastening problems,

Outstanding fastener design and production experience that assures you the best possible design of SPEED NUT, whether it is a special SPEED NUT or one of the 10,000 SPEED NUT brand fasteners presently available,

Stringent control of SPEED NUT quality from coil strip to you, including die design, production, heat treatment and finishing.

Be sure you specify "Tinnerman T-marked SPEED NUTS" that give you better fastening, that cut parts and assembly costs, that never let you or your customer down. *Tinnerman Products, Inc., Dept. 12, Box 6688, Cleveland 1, Ohio.*

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Tapered Seat

Edward W. Schrader, Western Editor

Operating in a manner similar to a valve, a plug unscrews two turns, allowing fluid to flow past its seat. Screwing the plug in again blocks the flow. The tapered plug uses a straight thread to seat its seal in the tapered bore of the nipple joined with the pipe line.

O-rings, carried by the plug and located on either side of the tapered seat, seal on the two straight bores of the nipple. These O-rings serve as static seals to prevent leakage through either side of the tapered seat; although the seals do move with the plug each time the plug is seated or unseated.

The tapered plug seal is packing material, suitably chosen for the fluid service, with a conical face slightly larger in diameter than the metal tapered plug. This creates a bubble-type seal when the plug is screwed into its taper.

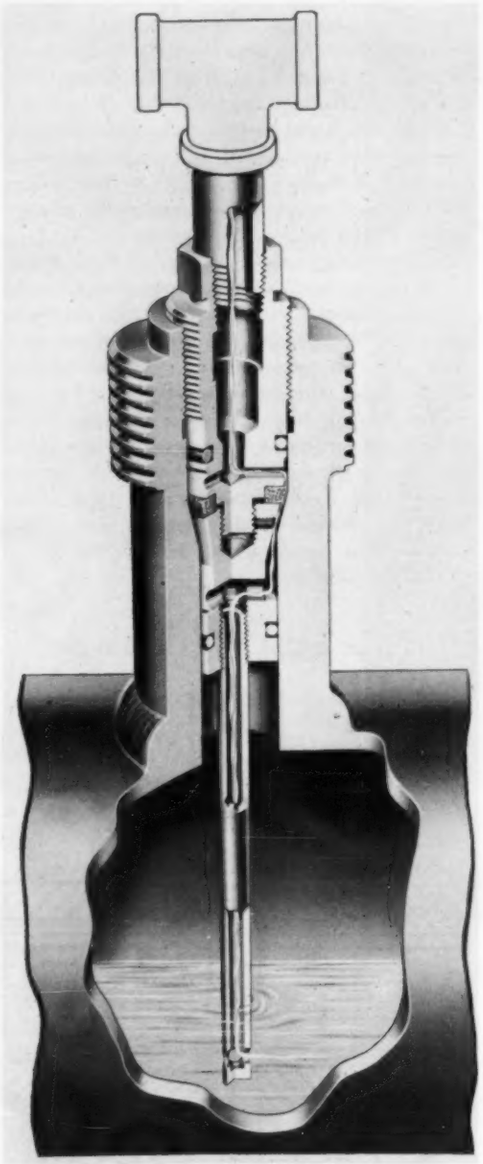
When used for sampling line fluid, a probe of the desired length is threaded into the end of the plug with a left-hand thread. The straight thread of the plug is right-hand.

To keep pressure drop through the probe and the plug at a minimum, the hole in the probe is the smallest area through which fluid passes. The end of the probe has four holes whose total area exceeds that of the probe inside cross-sectional area. Similar passageways are provided in the plug. The two turns required of the plug to pass fluid around the seat create a flow area at the seat larger than the flow area in the hole of the probe.

Probe length varies for line size and for position in line to be sampled. The adapter nipple to the plug has a left-hand thread. Either a pressure gage or a sample accumulator may be used on the plug.

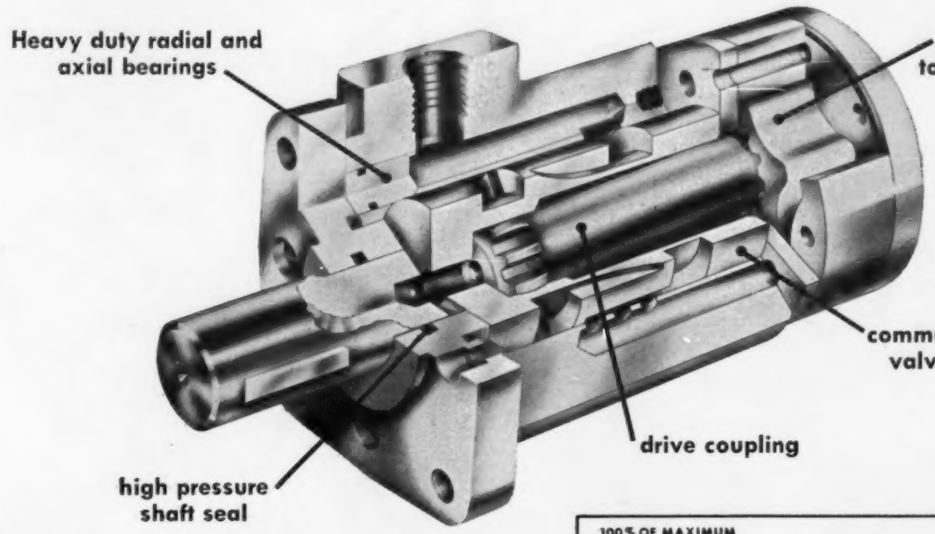
The product sampler and access fitting with the tapered seat seal is a design development of Cosasco Div., Grant Oil Tool Co., Los Angeles, Calif.

Seals Pipe-Line Sampler



ACCESS FITTING uses tapered seat and seal on straight-threaded plug to seal against leakage. Two turns of plug retract seal from tapered bore, allowing fluid to pass, or pressure be measured, without disturbing fluid line. Design avoids making and breaking of line to insert pressure gage or sampler. Simple valve arrangement in access fitting avoids valve tree on line.

New Hydraulic Motor Design Provides High Torque at Low Speeds



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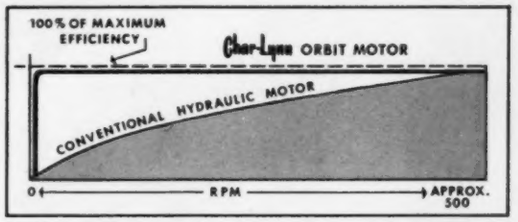
The Orbit principal utilizes an internal gear mechanism to act both as a fluid displacement motor and a gear reducer. The outer segment is a stationary part of the motor housing and has internal gear teeth which mesh with corresponding teeth on a smaller gear or rotor which rolls inside the outer gear, turning about an eccentric axis in an ORBIT.

The rotor gear rolls through six complete orbits during each single rotation of the output shaft. Thus an effective speed reduction of 6-to-1 is obtained. The use of seven fluid chambers with the inherent 6-to-1 ratio provides 42 fluid power cycles per shaft rotation, a distinct advantage in obtaining smooth rotation.

As it rotates, the rotor gear causes a continuous opening and closing of the spaces between the teeth. Half of these spaces are subjected to fluid pressure and the opposed half is connected to the return section of the motor.

The rotary commutator valve distributes the fluid so that the pressured space rotates in phase with the rotor gear, thus causing continuous rotation. Motion of the rotor gear is transmitted to the output shaft by a coupling which has crowned involute splines to match the bores of the output shaft and the rotor gear.

The high pressure shaft allows ORBIT MOTORS to be operated "in series" without external drain lines.



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- **Starting torque substantially equal to running torque**
- **Full reversible—instant starting, stopping**
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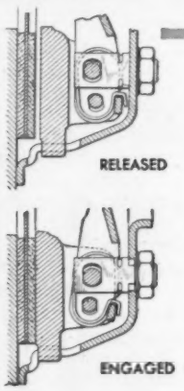

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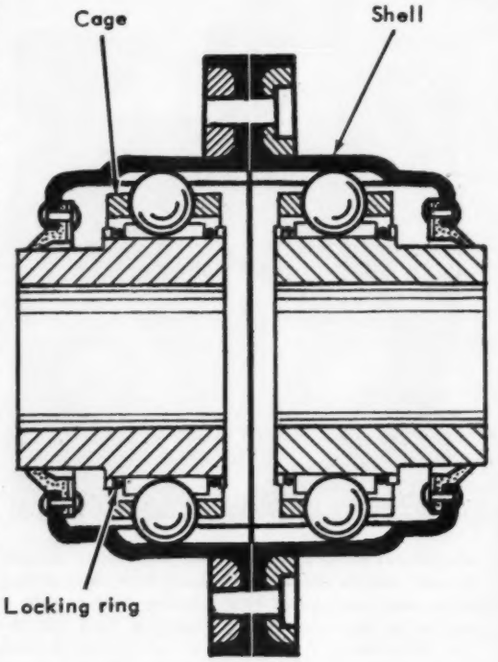
PATENTS

Aligned Antifriction Shaft Coupling

U. S. Patent 2,983,118; John R. Wicoff, Gary, Ind.

Utilizing ball and recess elements to reduce friction, this coupling allows slight misalignment, sealed-in lubrication and fast assembly or disassembly. Each hub consists of a sleeve with enlarged end portions. A series of shallow semi-cylindrical channels is provided in the exterior surface of each end portion, and split retaining or locking rings are located in annular grooves at each end of the hub. A cage for each hub retains ball elements which are confined in the grooves and in similar grooves in a housing.

The housing or shell consists of two complementary cylindrical sections coupled together by bolts extending through flanges. Along the major portion of their length, the sections of the shell have channels corresponding with the channels in the hubs. The outer extremities of the two shell sections have inturned flanges. These flanges are secured to the exterior surface of the hubs through resilient packing and sealing washers and rivets or retaining rings. Thus, a fluid tight seal prevents dust or foreign matter from entering the coupling and permits the use of permanent lubrication.

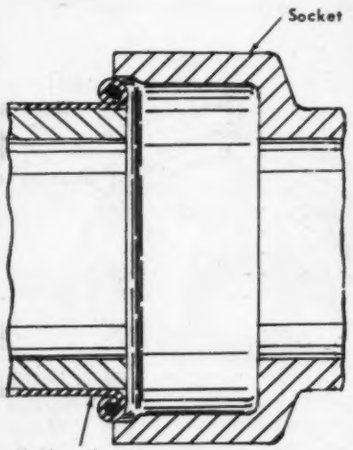


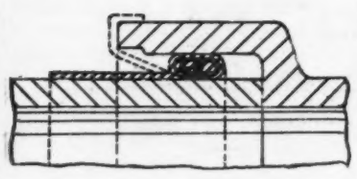
Pipe Joint

British Patent 866,902; Wilfred Noble, Francis H. Clews, British Ceramic Research Assoc., Queen's Road, Penkhull, Stoke-on-Trent, England.

Applicable to earthenware, concrete or metal pipe, this simple joint consists of a rubber sleeve with rough-patterned inner surface. One end has an enlarged edge in which a resilient ring is inserted to form a bead. The sleeve is applied over a plain or spigot-ended pipe with which it makes frictional contact. The ring is rolled over upon the sleeve until large enough to engage frictionally a socket-ended pipe.

When sleeve and bead are in position, they are pushed into the socket. The bead rolls over on itself progressively increasing in volume and/or compression. With the pipe fully inward, the rolled-over portion of the sleeve is squeezed between spigot and socket. The joint allows for expansion, contraction, linear and angular displacement.





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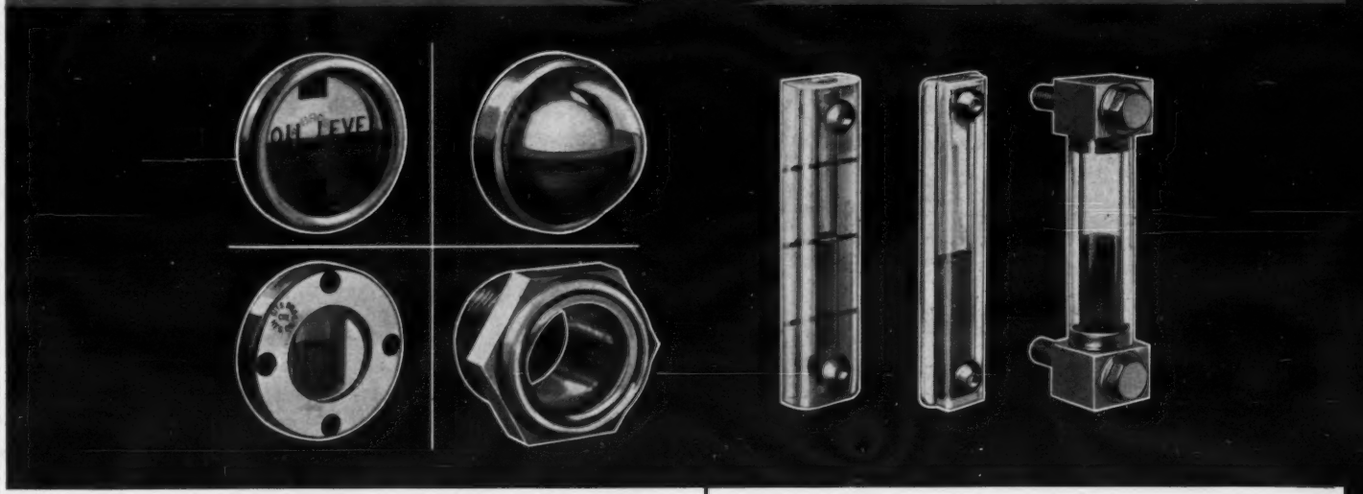
168 Gits view gauges



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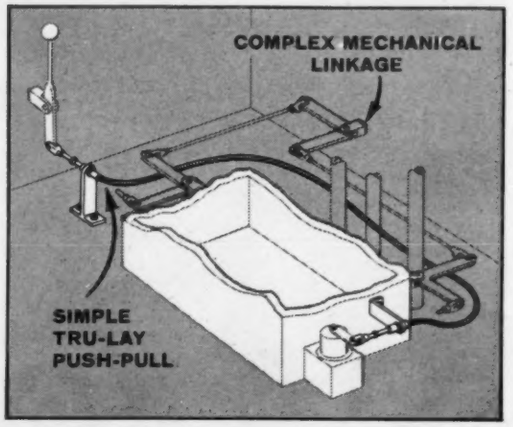
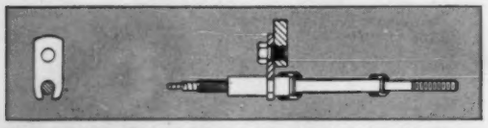
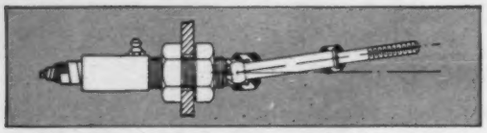


THESE FEATURES HELP SOLVE DESIGN PROBLEMS

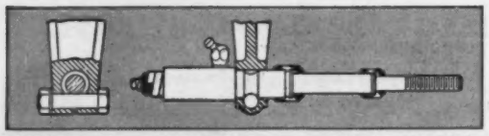
Anchorages



Clip anchorage • a simple clip for light loads

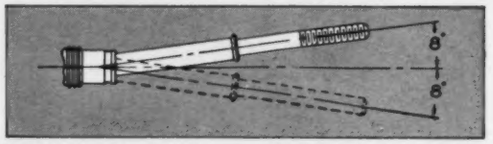


Bulkhead anchorage • for heavy-duty installations



Machined bracket anchorage • can be furnished for mounting any PUSH-PULL cable at the swivel terminal

Swivel Action



Standard assemblies have end fittings with a swivel movement of ± 8° to compensate for misalignment and rise or fall of lever arms. Swivel joints, and the sliding ends, are sealed against dirt and moisture.

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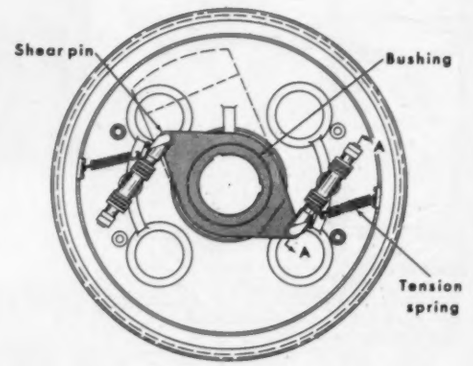
PATENTS

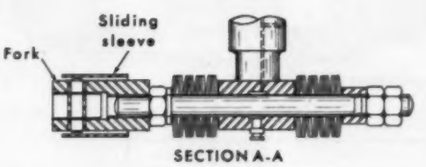
Torque Overload Protection

British Patent 867,715; Beteiligungs-und Patentverwaltungs GmbH., Altendorfer Strasse 103, Essen, Germany.

This patent covers a device designed for limiting the torque transmitted from driving to driven members mounted on a common axis. The device consists of V-pulley rotatably mounted on a bushing keyed to a shaft. The bushing has ears containing sleeves which accommodate shear pins. The outer ends of each shear pin are received in sleeves journaled in forked holding members. The pins are prevented from dropping out of the holding members by sliding sleeves. A tie rod screwed into each member is slidable in a fixed sleeve attached to a retaining bolt, rotatably mounted in the V-pulley. Plate springs surrounding the tie rod are clamped between a nut and a guide sleeve and this sleeve and an abutment sleeve. An ear on each holding member is connected by a tension spring to the V-pulley.

The driving torque of the pulley is transmitted through the bolts and springs to the tie rods, to the holding members and then through the shear pins to the shaft. When the predetermined torque is exceeded, the pins shear at their weakened points and the shaft ceases to rotate. Continued rotation of the pulley causes the springs to pull the members and tie rods outward to rest positions in which the ears are clear of the device.





The following list compiled from recent issues of the Patent Gazette gives you increased coverage of new patents whose details may be useful to product and machine designers. Copies may be obtained from the U. S. Commissioner of Patents, Washington, D. C. The price is 25c each.

FLEXIBLE COUPLING MEMBER
U S Patent 3,000,197; Hans Ruegg and Richard Keller, Ruti-Zurich, Switzerland, and Albert Klopfer, Stuttgart, Germany, assignors, by mesne assignments, to Allpatent AG., Vaduz, Liechtenstein.

FLEXIBLE COUPLING FOR DRIVE SHAFTING
U S Patent 3,000,198; Ellarson R. Stout, Fayson Lakes, N.J., assignor to Curtiss-Wright Corp.

TEMPERATURE-COMPENSATING COUPLING MEANS FOR LIQUID METERS
U S Patent 3,000,211; Lester D. Friel, Minneapolis, Minn., assignor to Minneapolis-Honeywell Regulator Co.

SPEED-CHANGE DEVICE
U S Patent 3,000,229; Joseph Dennis Christian, San Francisco, Calif., assignor to Holo-Flite International, Inc., San Francisco, Calif.

PLANETARY TRANSMISSION
U S Patent 3,000,235; Howard W. Simpson, 730 Crescent Dr., Dearborn, Mich.

ELECTROMAGNETIC PLUNGER PUMPS
U S Patent 3,000,321; Leland C. Parker, Rochester, N.Y., assignor to General Motors Corp., Detroit, Mich.

VALVE STRUCTURE
U S Patent 3,000,393; Wallace J. Maynard, 6219 San Ricardo Way, Buena Park, Calif.

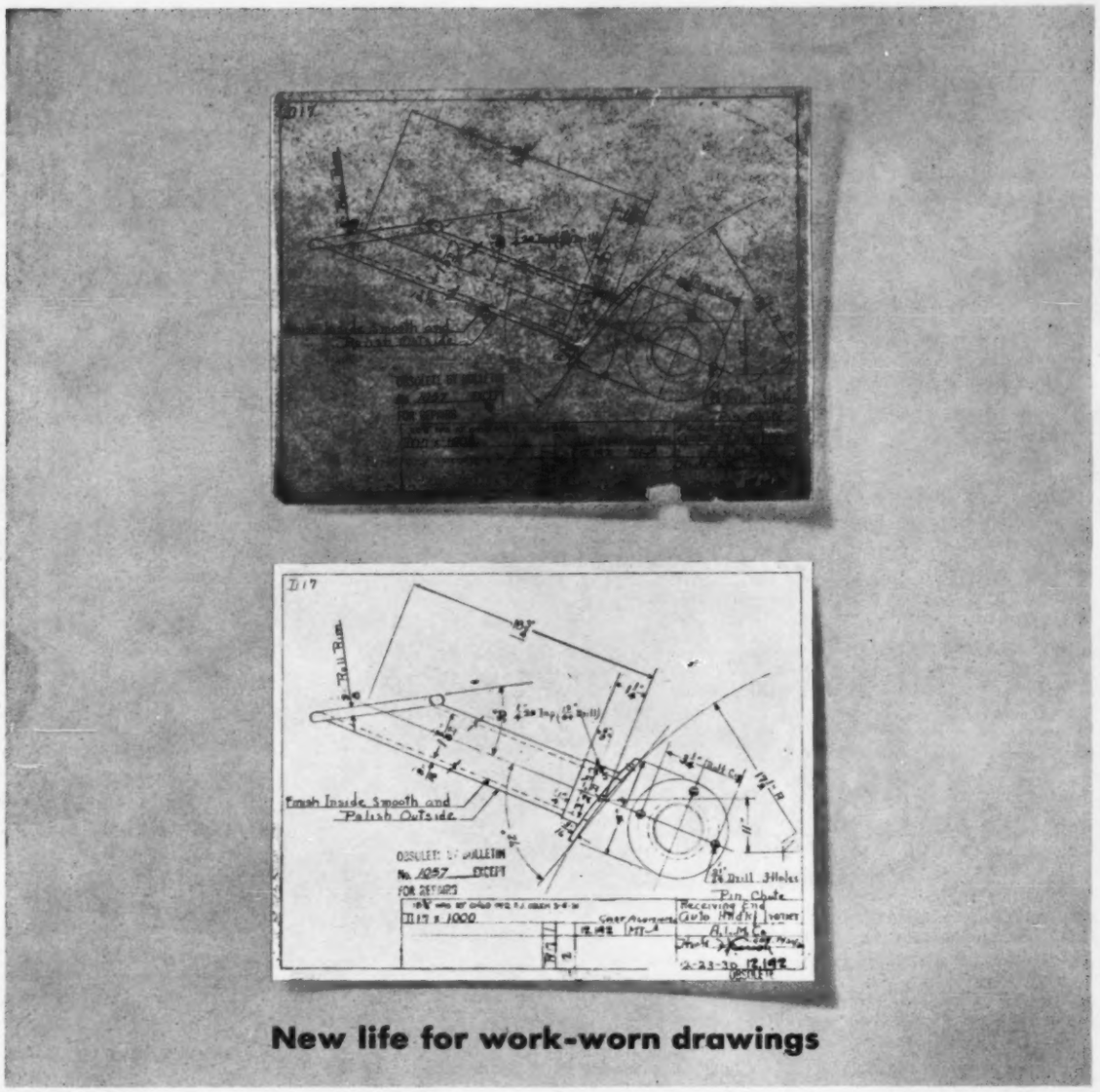
GOVERNOR
U S Patent 3,000,394; Harold Gold, Shaker Heights, and David M. Straight, North Olmsted, Ohio.

FORCED-AIR COOLED BRAKES
U S Patent 3,000,472; Gerald P. Sturgis, 416 W. 11th St., The Dalles, Ore.

CLUTCH-BRAKE MECHANISM
U S Patent 3,000,478; Horace Johnson Carter, Wilmington, Del., assignor to Ferracute Machine Co., Bridgeton, N.J.

HELICAL-COIL-TYPE CLUTCHES
U S Patent 3,000,481; Donald M. Tomko, Cleveland, Ohio, assignor to Curtiss-Wright Corp.

LIQUID SPRINGS
U S Patent 3,000,622; John Hales, Hatherley, Cheltenham, England, assignor to Dowty Rotol, Ltd.



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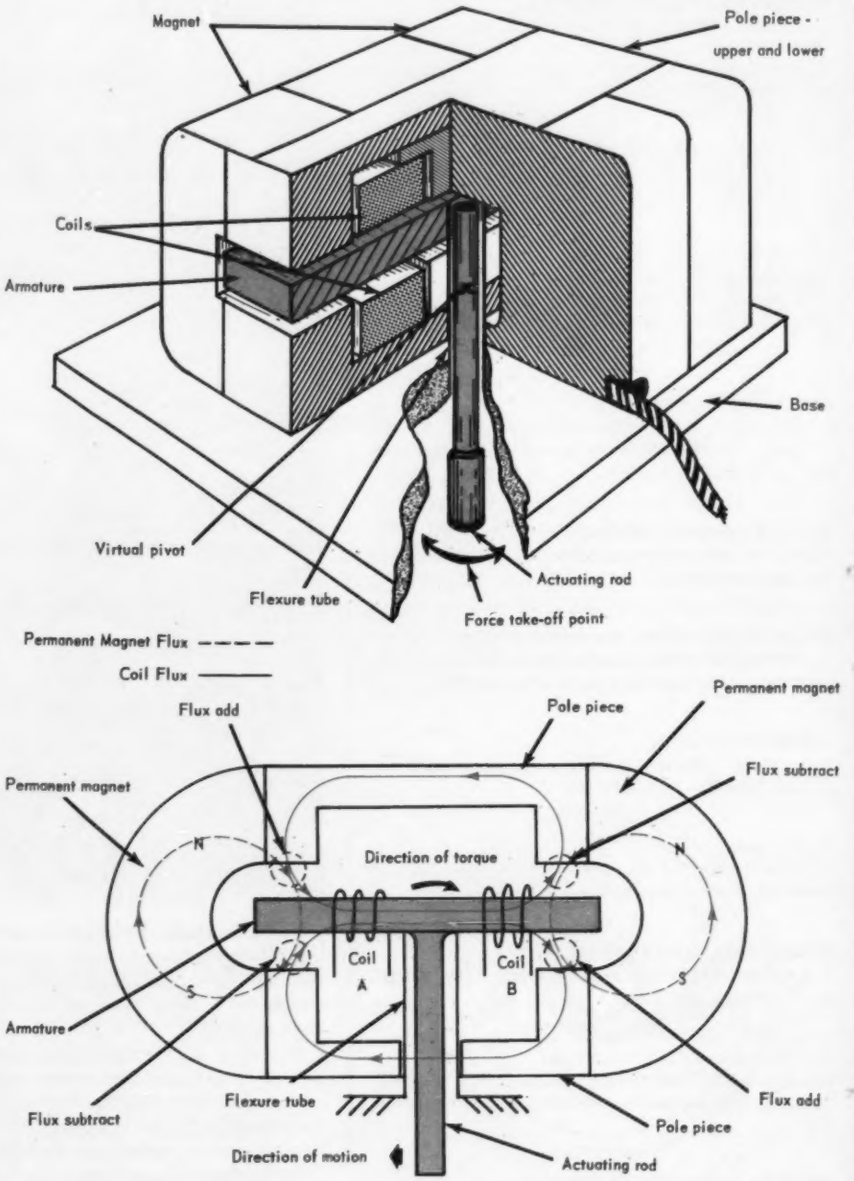
DESIGN IDEAS NEWS — ELECTRICAL

Flexure Tube Supports Armature



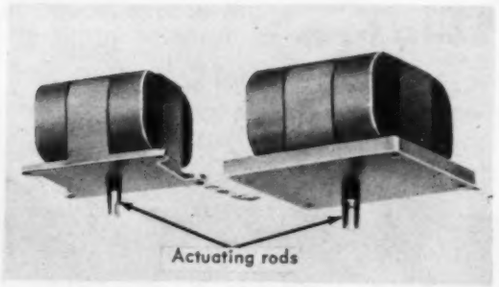
WORKING FLUID is completely sealed from torque motor's air gaps. Transducer converts electrical to mechanical energy and transmits it across sealed boundary for use in electrohydraulic, pneumatic and mechanical control systems. Tube has spring stiffness to restrain armature compatible with desired torque-motor operation. Permanent magnets provide polarization flux. Differential d-c current applied to coils produces flux which adds and subtracts from polarization flux in four gaps so as to upset balanced bridge and effect armature movement. Armature motion is produced until restraining force of flexure tube balances magnetic flux. Angular motion of armature then is related linearly to applied differential current.

and Seals Air Gaps

Victor W. Wigotsky, Eastern Editor

A stainless-steel (or beryllium copper) tube acts as a seal and flexure support in a dry-coil torque motor. The tube prevents magnetic particles from entering the gaps and provides support and restraining force for the armature.

An actuating rod inside the tube is the means of force take-off, through which angular motion of the armature is converted to translatory motion of a load. The rod is brazed at one end inside the flexure tube. The subassembly of tube and actuator rod then are brazed to the armature.



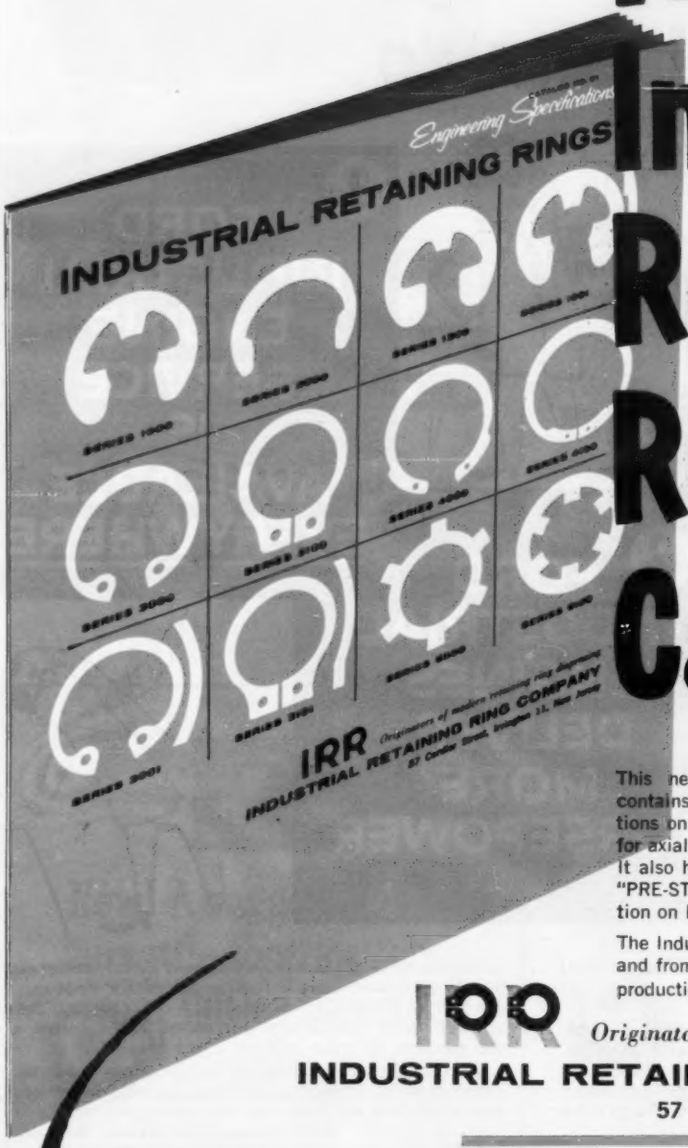
MOTIONS of 10 to 15 milliradians rotation of actuating rod, or 0.005- to 0.015-inch displacement at point 1/2 inch below base of torque motor, can be provided. Midposition forces from 2 to 12 lb can be achieved.

The bottom end of the tube next is brazed to the torque-motor frame. Armature, tube and rod then bend as a unit around a virtual pivot point halfway up the flexure tube. The armature is torqued until the restraining influence of the flexure tube balances the magnetic force, resulting from a differential d-c current applied to the coils.

The flexure tube functions in place of two torsion shafts previously used to support the armature. The simple tube support also acts as a frictionless seal which withstands pressures to 5000 psi and temperatures to 500F. Only a lightweight dust cover for the motor assembly is necessary. Previously, a heavy pressureproof cover was required.

The dry-coil torque motor was designed by American Measurement and Controls, Inc., subsidiary of CompuDyne Corp., Waltham, Mass.

For YOUR File . . . **New! Industrial Retaining Ring Catalog**



This new Industrial Retaining Ring Catalog, No. 61, contains complete information and engineering specifications on IRR Internal and External Retaining Rings—both for axial and radial assembly—from sizes .040" to 4.125". It also has information of the exclusive, time-saving, IRR "PRE-STACKED" Axial Assembly Rings as well as information on IRR Pliers and Accessories.

The Industrial Retaining Ring Catalog is easy to work with and from. It will greatly assist in design, purchasing and production.

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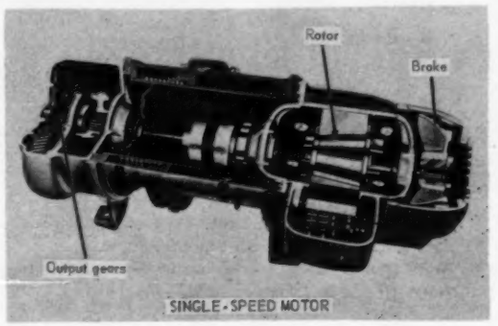
Axially Sliding, Conical Rotor

R. F. Stengel, German Editor

Conical rotors and stators result in compact design of a new line of motor-brakes. With power off, a compression spring slides the rotor axially about 0.04-0.06 inch which forces the brake cone against a friction surface. When power is applied, the resultant of magnetic forces overcomes the force of the compression spring, releases the brake and returns the rotor to running position.

The basic unit is available as a cage rotor with 2, 4, 6 or 8 poles and 0.11-34 kw, as a slip-ring rotor with 4, 6 or 8 poles and 1.1-27 kw and as a gear motor with output speeds of 280 to 5 rpm and 0.4-30 kw. Sensors inside the winding monitor temperature and stop the motor immediately when overheating occurs.

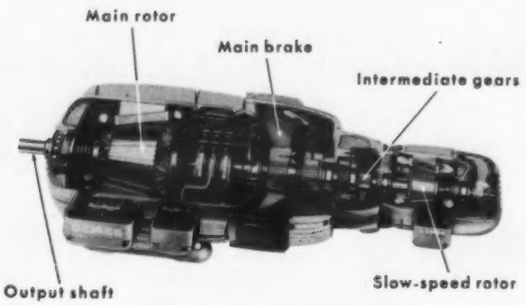


SINGLE-SPEED MOTOR

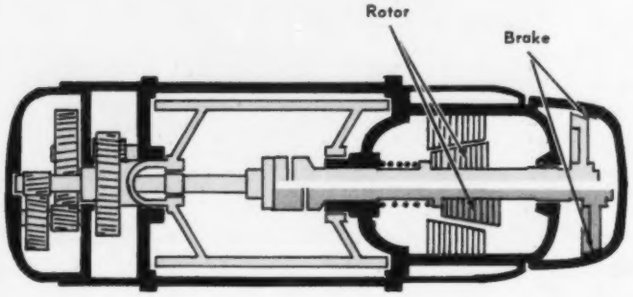
A combination of two motors provides dual-speed operation. In slow range, the slow-speed motor acts on the output shaft through intermediate gears and through the engaged brake of the main motor; the main brake functions as a clutch. For high speed, the main brake is disengaged, the slow-speed motor rests and the output shaft is driven directly by the main motor.

Series P and Series F (dual speed) motors are products of Demag-Zug GmbH, Wetter (Ruhr), Germany.

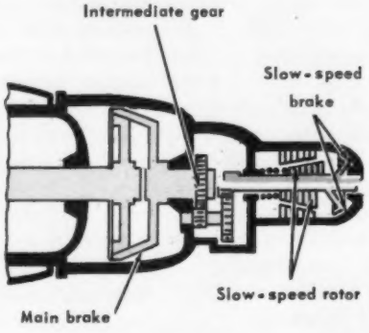
Simplifies Motor-Brake Design



DUAL-SPEED MOTOR

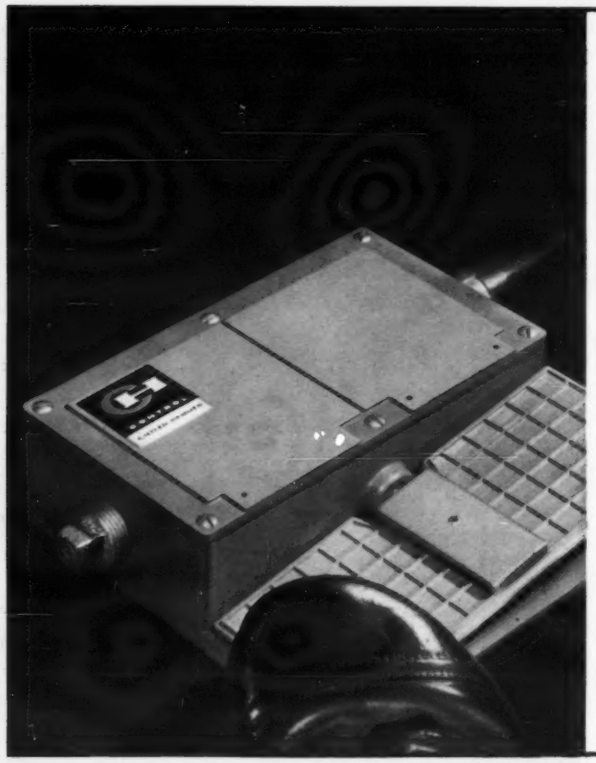


MAIN MOTOR



SLOW-SPEED SECTION

RUNNING AND BRAKED POSITIONS of axially sliding rotors.



CONTROL

New! A rugged line of versatile foot switches from Cutler-Hammer

These new foot switches can be stepped on, kneed, elbowed, palmed. You design them in—they'll improve operations. Same high quality in these foot switches you find in all Cutler-Hammer motor control. You get versatile operation, too. The heavy duty, side treadle switch has three interchangeable operating arrangements that can be changed easily just by changing position of a nylon cam.

Find out about the heavy-duty side treadle switch, standard-duty switch, palm switch and heavy-duty treadle switch. Send for Pub. LO-91-X272.

WHAT'S NEW? ASK...

CUTLER-HAMMER

Cutler-Hammer Inc., Milwaukee, Wisconsin • Division: Airborne Instruments Laboratory • Subsidiary: Cutler-Hammer International, C. A. • Associates: Cutler-Hammer, Canada, Ltd.; Cutler-Hammer, Mexicana, S. A.

Circle 28 on Reader-Service Card for more information

REPUBLIC OFFERS

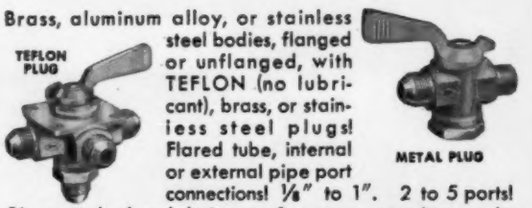
TYPES **MORE** PORTINGS

TEMPERATURE RANGE SHAPES

PLUG DRILLINGS MATERIALS SERVICES

IN SIZES

PLUG VALVES



Brass, aluminum alloy, or stainless steel bodies, flanged or unflanged, with TEFLON (no lubricant), brass, or stainless steel plugs! Flared tube, internal or external pipe port connections! ⅛″ to 1″. 2 to 5 ports! Six metal-plug lubricants for many services—air, vacuum, water; gaseous oxygen; alcohol; gasoline and high octane fuels; hydrocarbons and hydraulic oils; acids and alkalis; and food. When you need plug valves, investigate Republic's broad line of standard types!!!

And special-purpose valves, too! There is one designed especially for drawing off accurate, minute samples for GAS CHROMATOGRAPHY analysis! Another, 3″ and 4″ SLURRY valves with rubber-covered rising plug for long service life! And a CYLINDRICAL plug type that features low pressure drop and easy turning.

Yes, Republic offers **more** in plug valves! What do **you** need?

Stocking distributors coast to coast 334

REPUBLIC RM

FLOW • DIRECTIONAL • PRESSURE CONTROL

VALVES

15655 Brookpark Road, Cleveland 35, Ohio

Circle 29 on Reader-Service Card for more information

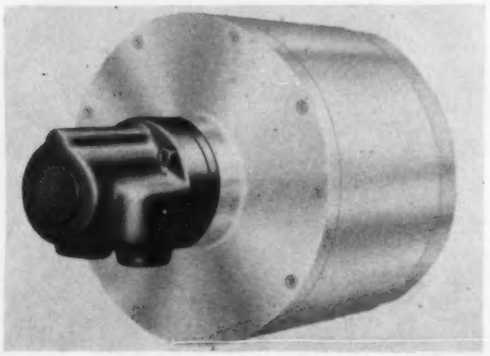
DESIGN NEW PRODUCTS NEWS

Circle number on Reader Service Card for more information

Double-Bearing Air Inlet For Air Cylinders

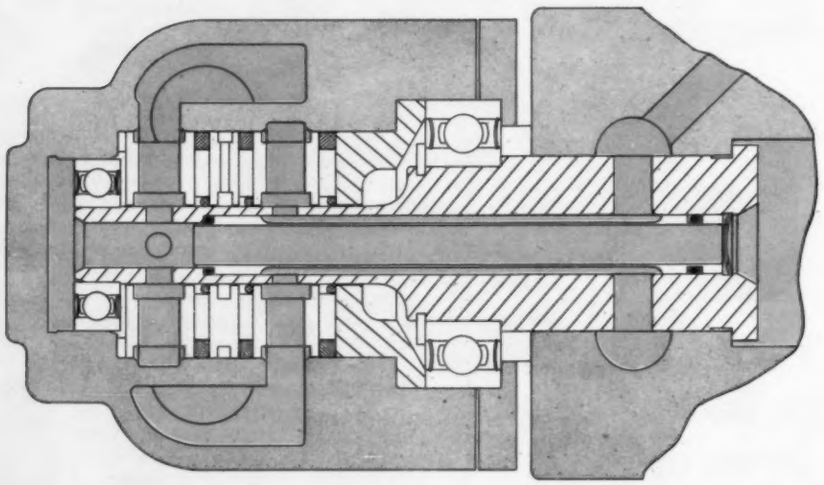
Allows Speeds to 4000 RPM

301



Spindle speeds to 4000 rpm on modern metal-working machines are possible with this double-bearing air inlet. The RM4 inlet has a special inlet seal that adjusts itself automatically through working pressure, reducing required maintenance. Designed with fewer parts, a smaller shaft and compact design, the unit is said to reduce vibration at higher operating speeds. The air inlet is available on rotating air cylinders of 3-, 4-1/2-, 6- and 8-inch bore sizes.

S-P Mfg. Corp., 30201 Aurora Rd., Cleveland 39, Ohio.



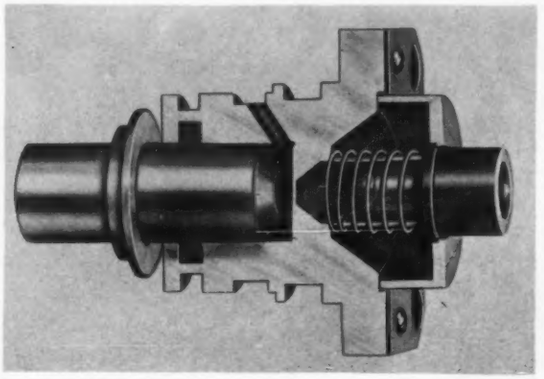
One-Micron Filter

Protection for Hydraulic Systems

303

Particles no larger than one micron in size now can be removed from fluids in high-tolerance hydraulic recirculating systems. This represents a five-fold improvement over the best previously available cartridge filters. Using MIL-H-5606A hydraulic fluid at 80F, the "Microtube" cartridge rated flow is 4 gpm at 40 psi differential pressure. The cartridge is rated for a maximum operating pressure of 200 psi differential pressure. Measuring 4-1/2 inches high by 1-25/32 inches in dia, the filter conforms to the envelope dimensions of AN-6235-D elements for use in Type AN-6234-4 and MS-28720-12 housings. The one-micron filter cartridge may be installed directly in existing ground support and test equipment for missile and aircraft recirculating systems with little or no alteration of system design.

Millipore Filter Corp., Bedford, Mass.



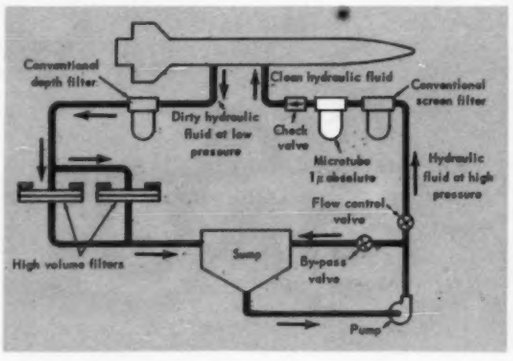
Hydraulic Indicator

Pressure Differentials Indicated with Simple Device

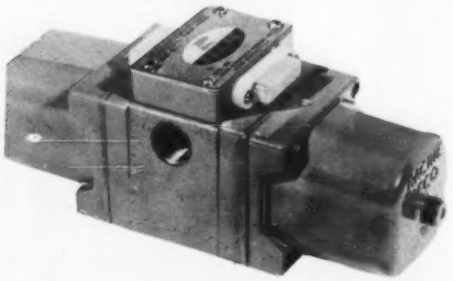
302

If system pressure exceeds a preset limit, the red indicator button at the top of this device pops out. In operation line pressure enters through the top, depressing lower magnet and allowing the spring-loaded upper magnet to rise with the red button. Called a "Deltadyne" indicator, the unit is available for system pressures to 10,000 psi and operating temperatures from −65 to 275F. Actuating pressures are adjustable or can be factory-set from 1.5 to 100 psi difference. Housings of aluminum or stainless steel allow the units to be used in corrosive service, as indicators for detection of contaminant build-up in filters, clogging in heat exchangers or indication of pump malfunction.

Pall Corp., 30 Sea Cliff Ave., Glen Cove, N.Y.



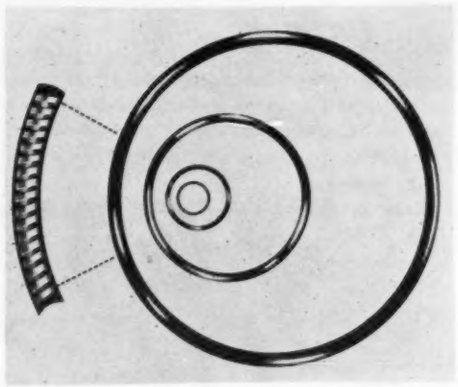
Solenoid-Controlled Valve with Pilot Light 304



A neon pilot light connected across the coil of this solenoid-controlled valve indicates if power is being applied. The valve pilot light reduces circuit trouble-shooting time and eliminates the cost of pilot-light wiring to control panels. Called a "Sentinel Light", the feature is available on 1/8-, 3/8- and 3/4-inch, 3000-psi, solenoid-controlled valves and also can be added to valves which are in use.

Racine Hydraulics & Machinery, Inc., Hydraulic Product Sales, 2000 Albert St., Racine, Wis.

High-Pressure Seal 305



The ruggedness of stainless steel is combined with the sealing qualities of "Teflon" in this line of seal rings. The "Astra-Seal" is said to produce greater tightness, durability and resiliency with an ability to follow the contour of the seal groove, surpassing rings of solid "Teflon". Rated for pressures up to 10,000 psi, the unit is chemically inert, has low friction and is usable from −450 to 400F. The seal is used in valves and lines carrying oil, water, liquid oxygen, nitrogen, helium, liquid fuels and other pneumatic, hydraulic or cryogenic fluids.

Carmac Aviation, 8414 San Fernando Rd., Sun Valley, Calif.

WE BROKE A DOZEN SCREWS, BUT

we couldn't make this sheet metal insert spin in its hole!

THE INSERT PROBLEM

A hole punched in thin sheet metal doesn't provide enough surface for threading. You often have to supply the threads by installing an insert.

But the same hole doesn't provide much surface for *gripping*, either. The insert spins.

WHAT WE DID ABOUT IT

The insert we tested was designed with an *angular* knurl around a cone-shaped gripping perimeter. Here's what happened:

First: When we mated the sheets, put in a screw, and tightened it in the insert, the screw pulled the insert toward the sheet. It also pulled the teeth of the angular knurl more firmly into the edges of the hole, increasing their resistance to spin.

We broke screws (No. 8, 10, 12, and ¼ sizes) by overtorquing them. But the only effect on the insert was to tighten it.

Second: When the insert was first pressed into the hole, the angular knurl displaced metal, squeezing it toward and into a groove around the bottom of the insert. This locked the insert against being pushed out before the screw was tightened. After tightening, the lock was intensified by the added squeezing pressure of the angular knurl.

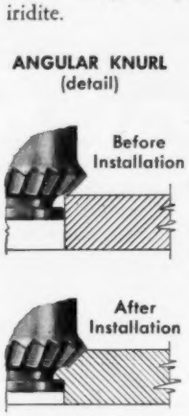
WE'LL SEND SAMPLES

If you've had this insert problem, drop us a line on your letterhead. We'll send some Southco THREDS (that's their name) for you to try. No obligation, of course. Write Southco Div., South Chester Corporation, 232 Industrial Highway, Lester, Pa.

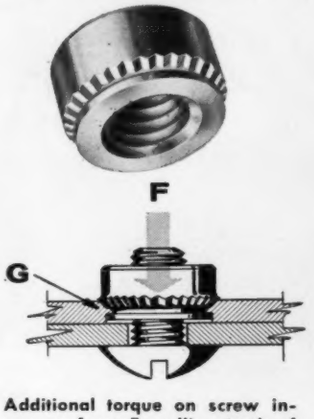
THREDS . . . AND THE ANGULAR KNURL PRINCIPLE

Southco THREDS are installed by pressing into a single hole in the sheet, provide thread length equal to or greater than that of a standard nut. One insert fits any sheet thickness (see minimum requirement, last column in table below). Material is case hardened steel, Cad. plated per Fed. Spec. QQ-P-416 Type II, cl. 2, yellow iridite.

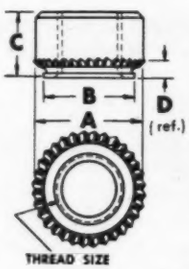
ANGULAR KNURL (detail)



Teeth bite into edge of hole, force metal into locking groove at base of insert.



Additional torque on screw increases force F, pulling teeth of angular knurl more firmly against sheet and putting extra pressure on metal in locking groove G.



SOUTHCO THREDS T.M. . . . SPECIFICATIONS

THREAD SIZE	PART NUMBER	A	B	C	D	Weight per M (lbs.)	Min. Sheet Thickness
4-40 NC	74-11-104-13	7/32	.185	5/32	3/4	1.22	.036
6-32 NC	74-11-106-13	7/32	.247	5/32	3/4	1.99	
8-32 NC	74-11-108-13	5/16	.278	3/16	3/4	2.87	.048
10-24 NC	74-11-110-13	5/16	.278	3/16	3/4	2.51	
10-32 NF	74-11-210-13	5/16	.278	3/16	3/4	2.53	
12-24 NC	74-11-112-13	13/32	.372	3/16	1/16	4.56	.060
¼-20 NC	74-11-125-13	13/32	.372	3/16	1/16	4.28	
¼-28 NF	74-11-225-13	13/32	.372	3/16	1/16	4.32	

©1961

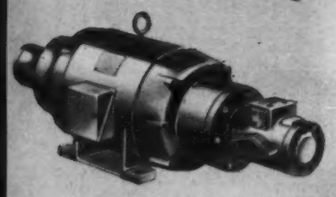
SOUTHCO FASTENERS LION

Circle 30 on Reader-Service Card for more information

BURGMASTER USES THESE VICKERS COMPONENTS

POWER PACKAGES—A complete Vickers 30-gallon hydraulic power supply was custom-designed and built for this machine. Vickers offers standard and custom power packages to meet every type of application need. Get details from your Vickers application engineer.

DIRECTIONAL VALVES—Two types of directional valves — solenoid operated and solenoid controlled, pilot operated—are used on this Burgmaster machine. The complete Vickers line of two- and four-way directional control valves is described in Catalog 5001C.



MINIATURE DIRECTIONAL CONTROLS—Series D1L two and four-way valves are designed for low volume systems, are suitable for operation to 1000 psi and have 2 gpm capacity. Low current a-c and d-c solenoids are available in all standard voltages. Write for data sheet D1L-1.

MOTOR PUMPS—A 5 HP, double-end motor pump is used on this Burgmaster. The complete Vickers motor pump line offers single, double, two-pressure and two-stage pumps. Use of these motor pumps conserves space and eliminates alignment problems between pump and motor. Details are available in Catalog 5001C.

VICKERS®

VICKERS INCORPORATED

DIVISION OF SPERRY RAND CORPORATION

Machinery Hydraulics Division

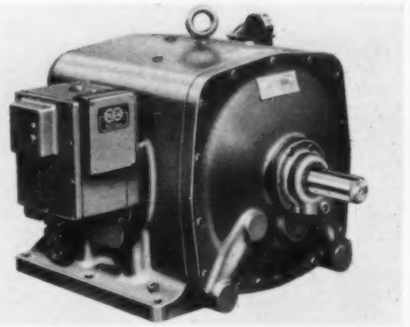
ADMINISTRATIVE and ENGINEERING CENTER

Department 1562 • Detroit 32, Michigan

9794

MECHANICAL

Servo-Controlled Hydraulic Pump — 306



Any number of variable low-level electrical input signals accurately vary the rate of pump flow from either directional port in this servo-controlled pump. A servo control valve directs low-pressure fluid to or from a stroker to vary the pump displacement from zero to maximum in 0.15 sec on small units and in 0.25 sec on the large units. A "fail-safe" device moves the pump to neutral if the power fails. The electrohydraulic servo-controlled pumps require power input only in proportion to the output demand. No power is lost in heat by throttling the fluid output. A complete line of manual or automatic-controlled equipment is available. Pumps range in size from 13 to 169 gpm for pressures up to 1350 psi and from 5 to 108 gpm for pressures up to 3000 psi.

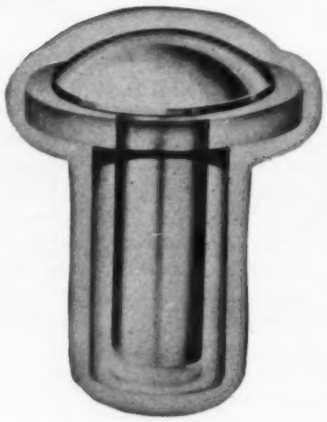
Oilgear Co., 1570-D W. Pierce St., Milwaukee 4, Wis.

Strain-Gage Protector — 307

This overload protector uses mechanical stops capable of an overload factor of 30:1 and a nonlinear spring network that protects in both tension and compression. The device prevents damage to strain-gage cells caused by overload. Standard models are available for load cells from 50 to 10,000 lb. Use of the unit does not require critical adjustment, nor does it affect dynamic response. The overload protector is for use in dynamometer torque measurements, electronic weighing systems, thrust measurements, solid-propellant tests and extended-range readouts.

Lebow Associates, 14857 W. 11 Mile Rd., Oak Park 37, Mich.

Nylon-Insulated Rivets — 308



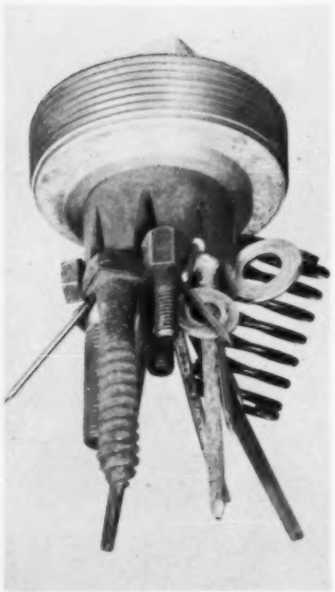
A nylon shell on these fasteners allows electrical insulation capable of withstanding nearly 5000v. The rivets can be used for assembling relay or switch contact pile-ups or for securing metal components to a chassis where it is necessary to have the metal components insulated. The nylon-covered rivets are also useful for fastening ceramic or glass components without danger of cracking them. The fasteners also are used where watertight or airtight joints are required. The "Insulets" have oval heads and semitubular shanks, and are offered in aluminum, brass, steel or other metals. The nylon covering extends slightly beyond the rivet's head circumference and along the shank beyond the end of the metal rivet.

Pylon Co., Inc., Attleboro, Mass.

Circle 31 on Reader-Service Card

Magnetic Plug for Processing Equipment 309

By using multiple-pole magnets, this magnetic plug retains its effectiveness after many ferrous pieces have been trapped. With a conventional two-pole magnet it is possible to short-circuit the magnetic field, making it less effective for further attraction. The "Tedeco Chip Trap" is intended for use in the fluid circuits of large processing equipment where trapping and holding of ferrous debris are important. Plug



bodies are galvanized cast iron, magnets are corrosionproof "Alnico" alloy. Six sizes are available, from 1-inch NPT having 4 poles and rated at 5-1/2-lb holding power, to 3-inch NPT with 8 poles at 70-lb holding power. Special sizes and threads may be ordered.

Technical Development Co., 305 S. Chester Pike, Glenolden, Pa.

Circle 32 on Reader-Service Card

ANTTI RAIHA, CHIEF ENGINEER, BURGMASTER CORP. SAYS:

"Hydraulic and tape controlled turret drills need sensitive, reliable power systems..."

". . . in order to control tool penetration and table positioning where location tolerances must be held to .001-inch. We've worked with Vickers hydraulic power systems since 1951, beginning with our automatic hydraulic models, we are increasing our activity in this area as the demand for turret drilling machines and tape controlled machines grows.

"In addition to the machine shown, we use Vickers hydraulics on seven different standard models as well as on many specially designed variations of these standard machines. We rely on Vickers hydraulic power systems, not only for their unusually high quality, but because they are easy to maintain and we have the additional assurance of the availability of their worldwide service organization.

"Because Vickers application engineers have given us close cooperation and have a thorough understanding of our requirements, we've been able to develop systems that provide long, trouble-free life."

Whether you are building standard or special purpose machinery, your power and control requirements can be met precisely and economically by the proper application of hydraulic systems. Typical Vickers components and systems used by Burgmaster are shown on the facing page. They are part of the broadest line of top quality hydraulics available anywhere.

VICKERS®

VICKERS INCORPORATED
DIVISION OF SPERRY RAND CORPORATION
Machinery Hydraulics Division
ADMINISTRATIVE and ENGINEERING CENTER
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This is an advertisement seeking critical materials. *Number 10 in a series*

Wanted:

25 POUNDS LUNAR DUST

For environmental testing of switches
and indicator lights we manufacture for space vehicles
and interplanetary industrial equipment.

For detailed product data write:

CONTROLS COMPANY OF AMERICA
CONTROL SWITCH DIVISION
1420 Delmar Drive, Folcroft, Pennsylvania

Manufacturers of the Electrosnap and Hetherington full line of switches, controls and indicators for all military and commercial applications. All standard units stocked for immediate delivery by leading parts Distributors.

Circle 33 on Reader-Service Card for more information

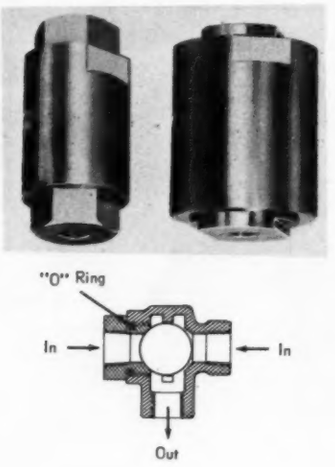
MECHANICAL

Absolute Pressure Relief Valve 310

This absolute pressure relief valve weighs only 0.3 lb but will maintain the pressure within an instrument compartment to a specified absolute value. The P/N 26100 is a single-stage, directly operated, relief valve incorporating a balanced poppet and an aneroid bellows. The valve can regulate the pressure of a compartment to ±0.25 psi from standard sea level to space at a constant nominal flow of 8 SCFM. The valve shows a 0.3-psi shift for 1 atmosphere change in ambient pressure.

Aerodyne Controls Corp., 90 Gazza Blvd., Farmingdale, L.I., N.Y.

Valve Switches Automatically 311

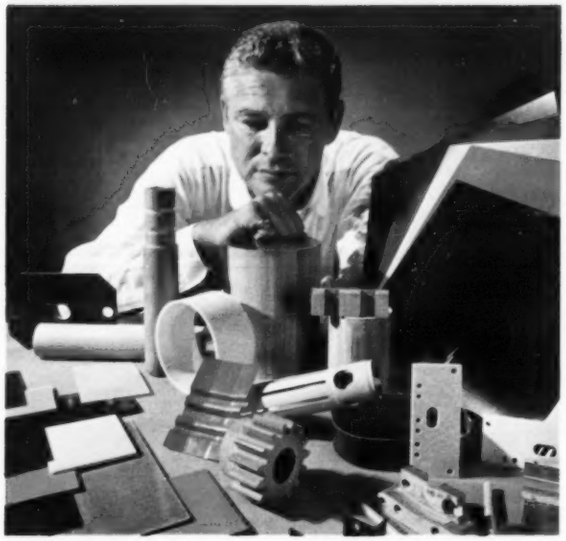


A single ball is the only moving part in this selector or directional valve. Controlled by the inlet port having the greatest pressure, the ball shuttles to one side and remains there until the flow direction is changed or pressure becomes greater on the opposite side. Used in hydraulic or pneumatic circuitry, the valves are designed for operation on pressures from 10 to 200 psi. They are available for 1/4- or 3/8-inch pipe. Other valve styles are obtainable for operation to 1000 psi.

Airmatic Valve, Inc., 7313 Associate Ave., Cleveland 9, Ohio.

Circle 34 on Reader-Service Card

116 reasons why we can help you put your finger on the right plastic faster



85 PHENOLITE® laminates...

3 thermoplastics—nylon, DELRIN,* PENTON†

16 grades of Vulcanized Fibre...

12 grades for printed circuits...

This will give you an idea of how surely National can help you pinpoint exactly the plastic you want. National has the broadest line in the industry, including standard forms, precision-fabricated parts, and a huge stock of many grades ready for immediate shipment. For fast help, samples, or more information, contact your nearby NVF sales office. You'll find the 'phone number in Sweet's Product Design File 2b/Na. Or write NVF, Dept. TF, Wilmington, Del. It's a direct line to the one best material per dollar of design performance.

NVF

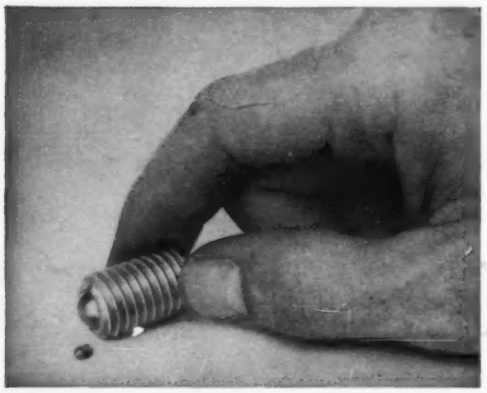
NATIONAL VULCANIZED FIBRE COMPANY
WILMINGTON 99, DELAWARE
In Canada: NATIONAL FIBRE COMPANY OF CANADA, LTD., Toronto 3, Ontario

* DELRIN IS A DU PONT TRADEMARK FOR THEIR ACETAL RESIN • † PENTON IS A HERCULES TRADEMARK FOR THEIR CHLORINATED POLYETHER RESIN

Practical Design Tips

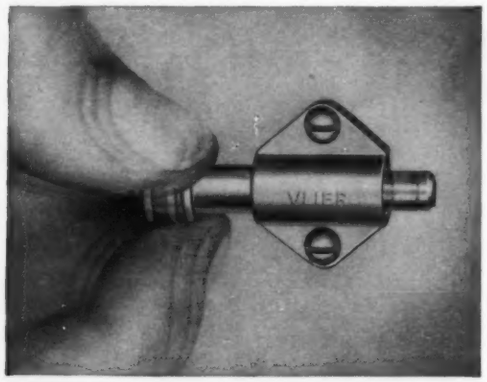
No. 4 of a series

Hundreds of companies are now saving by using off-the-shelf Vlier products like the ones shown below. These simple, low cost, precision parts save designers time and, in many cases, simplify product design and manufacture. Why not investigate their possibilities today.



BALL PLUNGERS WORK BETTER than spring plungers when side loads are involved. Balls won't bind from side thrusts, retract easily. Available in 10 standard sizes from 4-48x3/16" to 5/8-11x1". Various end pressures. Special sizes and end pressures made to quantity orders.

TORQUE-LIMITING WRENCH for assembling small parts, adjusting set screws, etc., is easily made from a Vlier Torque Handle and a length of hexagon stock. Prevents over-tightening, and subsequent damage to parts. End pressure is adjustable from 15 to 200 lbs.



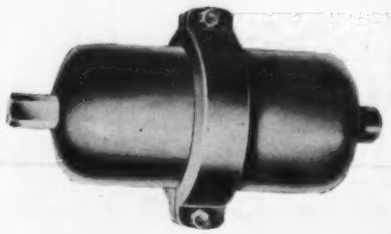
NEED A SMALL, LIGHTWEIGHT, SPRING-LOADED LATCH? One enterprising designer modified a standard Vlier S-88 Spring Stop that did the job perfectly. Entire latch weighs less than 1/3 oz. Body is die-cast aluminum; plunger is heat-treated alloy steel. Various plunger pressures. Available on quantity orders only.

FREE IDEA BOOKLET. Illustrations in this 16-page booklet show how others have profited from the use of Vlier products. Illustrates both the usual and unusual applications. May suggest ways *you* can save. Write for your copy today.

VLIER
Engineering Corporation
A subsidiary of Barry-Wright Corporation
8900 Santa Monica Blvd. • Los Angeles 46, California

Circle 35 on Reader-Service Card for more information

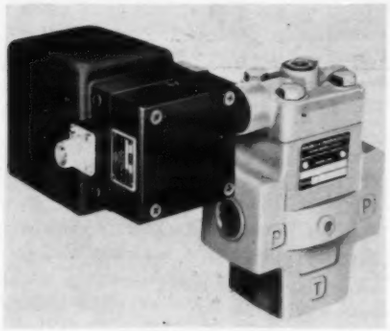
Hydraulic Accumulator with Polyurethane Hat 312



A polyurethane "hat" or diaphragm allows simpler design and the use of fewer parts in this hydraulic accumulator. Replacing the usual rubber "hat", the polyurethane allows elimination of the guide spring and the retainer plate from the diaphragm. Three times as strong and having greater chemical and temperature resistance (−80 to 250F), the accumulator has an increased hat life, easy maintenance, increased capacity and a reduction of failure through overcharge.

Special Products Co., Box 592m, Golden, Colo.

Adjustable Relief Valve 313



Two pressure settings are possible with this motor-adjustable relief valve. The two pressures to 5000 psi are set by limit switches in the actuator. The actuator motor turns an eccentric cam which alters the compression of the relief valve control spring, changing the line pressure required to open the valve. The BT-06 valve is equipped with a 115v a-c motor and is for use on 3/4-inch hydraulic lines.

Double A Products Co., subsidiary of Brown & Sharpe Mfg. Co., Manchester, Mich.

Fights Flux Attack to Cut Brazing Costs

Because of the severe destructive effects of flux used in aluminum and copper brazing processes, proper alloy selection and quality construction are the only answers to long belt life in this type of operation. Cambridge Cambriloy 35-19 Metal-Mesh Belts have successfully withstood flux attack in many copper brazing installations for as long as 6000 hours, giving users continued production of quality parts while cutting operating and maintenance costs.

There is a complete line of Cambridge Belts in special and standard metals and alloys to meet your specific requirements—custom built in any weave to insure the most efficient processing.

Experienced Cambridge Field Engineers—experts in their field—are available to discuss your needs and help you select the best belt suited to your operations. Or, they can offer you sound advice on the installation, operation and maintenance of your Cambridge Belts. Talk to your Cambridge man soon. He's listed in the Yellow Pages under "Belting, Mechanical." Or, write for free 130-page reference manual.

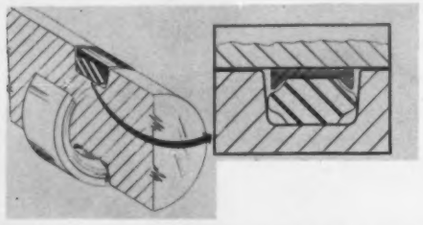
The Cambridge Wire Cloth Co.

DEPARTMENT D • CAMBRIDGE 11, MARYLAND

Manufacturers of Metal-Mesh Conveyor Belts, Flat Wire Conveyor Belts, Wire Cloth, Wire Cloth Fabrications, Gripper® Metal-Mesh Slings

Circle 36 on Reader-Service Card for more information

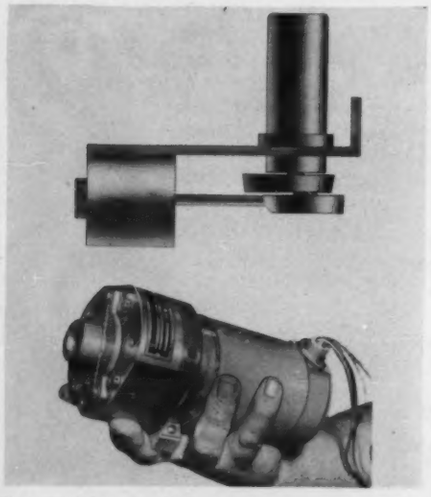
Shouldered Sealing Device 314



This sealing device uses a "Teflon" cap supported on an elastomer ring with an unusual cross-section. The ring provides shoulders, making it self-centering in the groove and preventing the cap from tipping in installation or operation insuring a positive seal to 3000 psi with no spiral failure. The "Teflon" sealing surface provides low break-out friction and minimum running friction. Called a "Plus Seal", the unit is offered as a set consisting of the "Teflon" cap and the elastomer ring. The seals may be installed in standard MIL-P-5514D O-ring grooves.

W. S. Shamban & Co., 11617 W. Jefferson Blvd., Culver City, Calif.

Miniature Compressors 315



These oil-free units weigh between 3 and 8 lb complete with motor, provide pressures to 100 psig, at volumes to 3 SCFM. They are said to be about 1/10 the size of compressors producing comparable volumes and pressures. Units require 3-phase, 400-cycle power.

Applied Pneumatics, Inc., 740 Colfax Ave., Kenilworth, N.J.

Performance, application and operating characteristics of new 2500 psi hydraulic vane pumps

By: Robert A. Manogue

Pumps/Controls Product Manager
Denison Engineering Division
American Brake Shoe Co.

In designing hydraulic circuits, it is normal to limit line velocities to a maximum of from 15 to 20 feet per second. This permits the use of the smallest practical lines, valves and fittings. Pressure drop in transmitting the fluid is thus dependent on flow velocity, number of valves and fittings and line length. For example, if the pressure drop of a given system is 50 psi, it represents a loss in transmission of 5% for a 1000 psi system and a loss of only 2% for a 2500 psi system. Power loss in transmission is reduced 60% by using 2500 psi components.

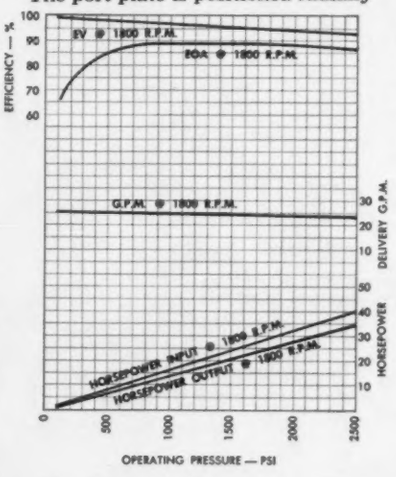
Net advantage is a more efficient hydraulic system with lighter weight and less cost-per-horsepower in smaller, more easily installed components than is possible with comparable lower pressure systems.

PERFORMANCE CHARACTERISTICS

Based on these inherent advantages for 2500 psi, Denison has engineered and produced a new series of "T1C" vane pumps with rated deliveries of 8, 11, 14 and 17 gpm at 1200 rpm and zero psi. Major considerations in designing the new pump were: Higher efficiency, speed and pressure for continuous duty to 2500 psi and 2500 rpm—as well as lower cost, ease of maintenance and compactness. The T1C pump shaft will support a radial load of 479 pounds at the center of the keyway.

PUMP CONSTRUCTION

The pump is a "cartridge" type design for quick, convenient servicing. It consists of a housing which provides an inlet connection, a bore for support of the shaft bearing and shaft assembly. The lip-type shaft seal is located outboard of the front bearing in the housing to permit bearing lubrication, using the fluid being pumped. A larger bore contains a floating front port plate, spring-loaded against the cam ring. The port plate is positioned radially by a dowel pin between the housing and port plate. The cam ring is located in a close-fitting bore and positioned radially by a dowel pin between the end cap and cam ring. Besides retaining the cam ring in the housing, the end cap contains suction and pressure cores and the outlet connection.



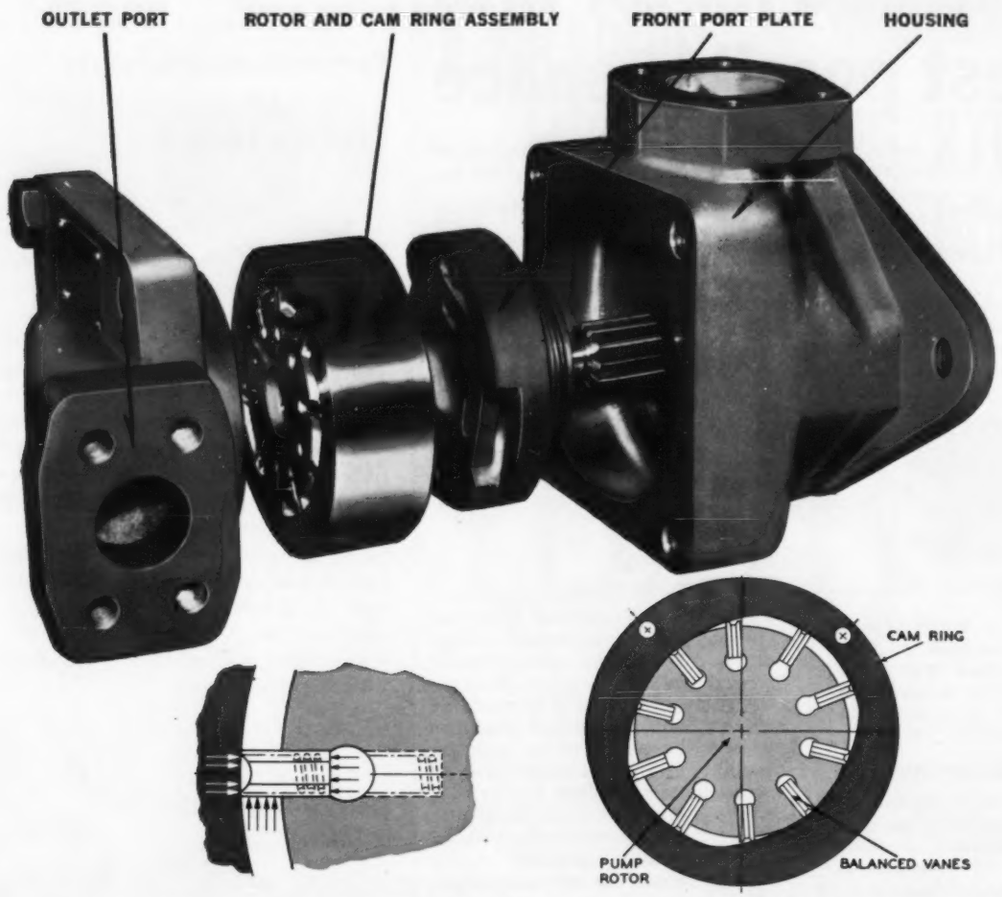
PERFORMANCE CURVES *demonstrate high volumetric efficiency of new 2500 psi Denison vane-type hydraulic pumps.*

To simplify piping, the end cap can be rotated to any one of four positions. The port pads on the pump match the four-bolt SAE port pads. An SAE "B" size mounting flange is provided on the standard pump. An alternate SAE splined shaft is available.

OPERATING CHARACTERISTICS

In operation, oil enters the pumping cavity through cast ports in the port plate and end cap. Oil is carried around to the discharge ports in the end cap and out the outlet port. The pump is internally drained at all times. The end cap contains a cored passage behind the bearing which allows a flow of oil through the bearing back to suction, keeping the bearing cool and minimizing wear.

A unique feature of the T1C pump is the floating front port plate which is free to move axially within limits. It utilizes hydraulic pressure to counteract internal hydraulic pressure that tends to separate the elements of the pumping cartridge after the pump is primed and delivering pressure to the circuit. A light spring



BALANCED OPEN-END VANE DESIGN *assures low wear through continuous pressure balancing which relieves hydraulic bearing loads between vanes and cam ring.*

ROTOR AND CAM RING ASSEMBLY *with large inlet ports for improved suction characteristics. Rotor is balanced axially and radially for consistently high volumetric efficiency and long life.*

is used to hold the pumping cartridge together when there is no pressure in the system and for starting. The floating plate construction minimizes scoring the wear faces on the front port plate and the end cap.

Oil flow in the pump is always from the inlet in the housing to the outlet in the end cap. Shaft rotation may be changed by simply repositioning the cam ring. Arrows indicate desired direction of rotation. The pump can be either flange or bracket mounted.

Other characteristics include: Oil, 150-300 SSU @ 100°F. Viscosity index, 90 or above. Minimum running viscosity, 65 SSU. Maximum viscosity at starting temperature, 7500 SSU. Data was determined with petroleum base oils.

APPLICATIONS

Among particularly suitable applications for new T1C pumps are: Mobile equipment—including earth-moving units, trucks, buses, tractors and power shovels where 2500 psi power can mean lower weight, increased payloads and greater user operating profit. Special machinery—including extrusion presses where the compact pump puts more power into less space. Automated production equipment—where feed circuits and index mechanisms benefit through the increased operating efficiency and low maintenance of 2500 psi hydraulics.

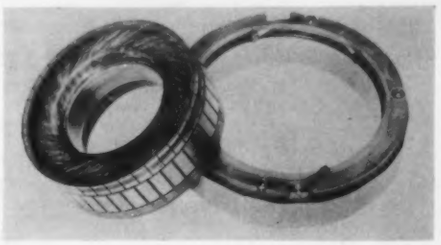
DESIGNERS and ENGINEERS

New 8-page Bulletin 200A includes specifications, performance and operating application data on new 2500 psi Denison balanced-vane hydraulic pumps. Write for your copy.

DENISON ENGINEERING DIVISION
American Brake Shoe Company
1190 Dublin Road • Columbus 16, Ohio

Circle 37 on Reader-Service Card for more information

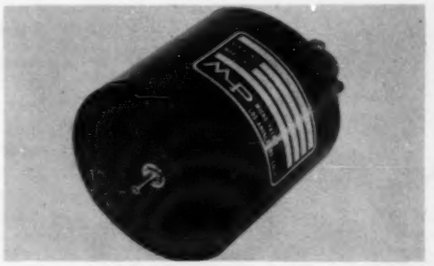
Frameless Torquemotor 316



Eliminating the gear train provides a very high order of angular resolution and response at the load. Providing a peak torque of 60 oz-in with an input power of 32w, the torquemotor has a theoretical acceleration at stall of 5450 rad/sec². Time constant for the motor is 0.0009 sec. Based on a frameless unit, the DCTM 29-2 measures 2.8 inches in dia, is 1 inch wide and weighs 14 oz. Standard models range from peak torques of 20 to 350 oz-in.

Giannini Controls Corp., 1600 S. Mountain Ave., Duarte, Calif.

Motor Adds Pulses 317



The output shaft of this stepping motor turns 9 deg each time an electrical step signal is applied. "Add" pulses step the shaft clockwise and "subtract" pulses counterclockwise, with forty pulses required for each revolution. The Model 611 stepping motor has 20 axial slots forming 10 pole sets for the armature. Four pole sets form the field structure. Direct current applied to the field coil causes the armature to rotate one step with each input pulse. Rotor inertia is 0.012 oz-in² with maximum load inertia of 0.12 oz-in². The motor will respond to a driving frequency from 0 to 6000 cps, providing operation from 0 to 9000 rpm. No-load position error per step is only ±0.5 deg (noncumulative). The motor is used for positioning code discs or transporting tape in accurate steps in computers.

U. S. Science Corp., 5221 W. 102nd St., Los Angeles 45, Calif.

How to get a pump and motor into the smallest possible space

by E. H. Schanzlin
Chief Engineer, Tuthill Pump Company

Today's designer faces stringent limitations on space and weight in more and more of his assignments. Miniaturization is the order of the day. Even if we exclude rockets, missiles, aircraft and similar applications, reducing the size and weight of pump and motor combinations can result in significant savings.

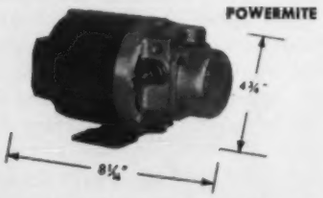
Compactness simplifies assembly operations . . . lowers production costs. Reduced weight means lower shipping expense. Elimination of components such as couplings, bases and adapters can mean substantial savings. And often a compact unit can provide the only feasible answer to a tough design problem.

Special Combinations Developed

Five years ago, Tuthill's engineering department initiated a special program to develop compact pump and motor combinations to provide the greatest possible savings in space and weight. The units on this page, plus others in our stock and on the drawing boards, are a result of this intensive and continuing program.

Powermite for OEM

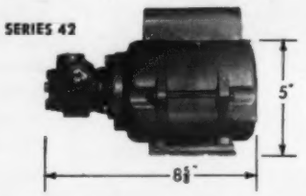
For original equipment applications involving substantial quantities, Tuthill's engineers have developed a special design in which the pump and motor are combined in one unit which takes up no more space and



weighs no more than a standard electric motor. The typical Powermite above, used in a hydraulic application, has a capacity of 16 gph at 350 psi despite its small size. Each Powermite is specially designed to meet the exact requirements of a specific OEM application.

Standard Units from Stock

In addition, Tuthill provides a wide selection of standard combinations immediately available from stock. Unlike the Powermite, the stock combinations can be furnished in single units, or any desired quantity.



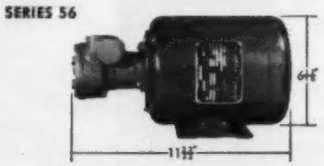
Here is a typical combination . . . series 42 totally enclosed ball bearing motors supplied with ratings from 1/12 to 1/6 hp, in combination with pumps with capacities of 20 to 45 gph at pressures to 200 psi.

Series 48 Combinations

A selection of series 48 combinations are normally supplied with totally enclosed fan-cooled motors of either split phase, capacitor or 3 phase construction, with ratings from ¼ to ½ hp. Pumps supplied in these combinations range from 20 gph to 360 gph at pressures to 360 psi. A typical combination measures only 7⅝" x 10⁷⁄₁₆".

Series 56 Units Available

Series 56 units measure 6¹¹⁄₁₆" x 11²³⁄₃₂" as shown. They are offered in a complete range of motors from ¼ to 1 hp . . . which can be coupled with pumps with capacities from 20 to 360 gph at pressures to 500 psi.



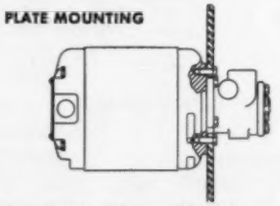
Many Others Available

Many other pump and motor combinations are available with capacities up to 50 gpm and for pressures to 500 psi. A new selection of closed coupled units will soon be offered with motor ratings to 5 hp.

Motors are normally furnished for 1725 rpm. However, they are usually available for 3450 and 1140 rpm as well. Explosion proof construction and double shaft extensions on motors are also furnished. Built-in relief valves and other modifications are optional.

Special Flange for Plate Mounting

For many applications a special mounting for close-coupled pump-motor combinations offers distinct advantages. Shown below, it allows the pump and motor to be mounted on any plate of sufficient thickness to bear the weight of the unit, by simply cutting a circular hole of sufficient size to allow the passage of the pump. It is particularly convenient for mounting on tanks, where it greatly simplifies piping arrangements. Through elimination of mounting flanges it further reduces space and weight.



Send Us Your Problem

In addition to these, Tuthill has developed a wide range of solutions to special problems involving pump-motor combinations. If you are trying to fit a pump and motor into a small space, take advantage of our experience. Write and give us the details.

Tuthill manufactures a complete line of positive displacement rotary pumps in capacities from 1/3 to 200 gpm; for pressures to 1500 psi; speeds to 3600 rpm.

PUMPS FOR YOUR PURPOSE

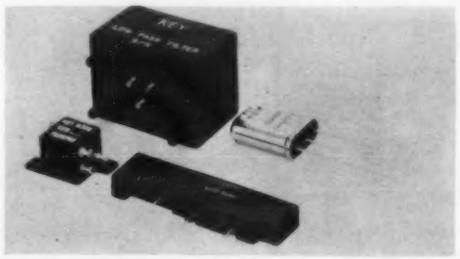
TUTHILL PUMP COMPANY

943 East 95th Street, Chicago 19, Illinois

Circle 38 on Reader-Service Card for more information

ELECTRICAL

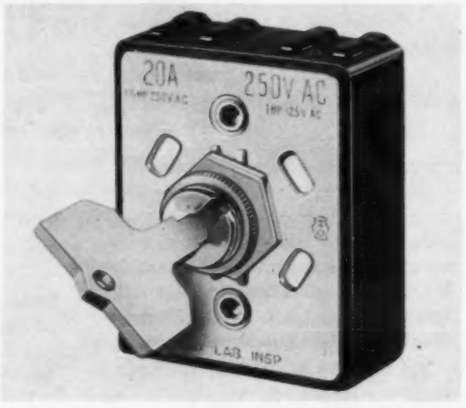
Custom-Shaped Networks 318



The problem of getting the necessary parts into the space available can be eased by the use of these RCL networks. Manufacturers using ladder networks, attenuators, bandpass filters or other RCL combinations can purchase them to exact electrical and physical specifications. The completely assembled epoxy-encapsulated modules fit any given size and shape. The custom circuits also are available in hermetically sealed packages with header terminations to meet customer specifications.

Key Resistor Corp., 321 W. Redondo Beach Blvd., Gardena, Calif.

Rotary Key Switch 319



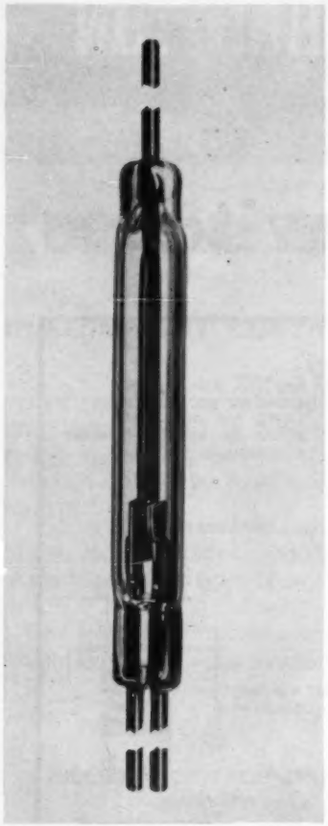
Requiring a key for operation, this rotary switch may be supplied with one or two wafers and from 2 to 12 positions. Available in a variety of circuit combinations, these compact switches allow the key to be removed in either the "on" or the "off" position. The device has a 5/16-inch long bushing for single-hole mounting and was designed for fans or air-conditioning units.

Cutler-Hammer Inc., 315 N. 12th St., Milwaukee 1, Wis.

SPDT
Reed Switch **320**

A switch assembly for reed relays now is offered with single-pole, double-throw contact configurations. The switch consists of two fixed contacts and one movable magnetic reed. The movable contact is spring-loaded against the normally closed nonmagnetic fixed contact and is magnetically actuated to the normally open magnetic contact. The design provides a normally closed reed switch without biasing the switch with magnets. Elimination of the biasing magnets reduces the space requirements for compact assembly. Life expectancy of the unit is in the millions of operations at full ratings. The contacts will switch up to 40w a-c resistive load at 250v with a contact resistance from 25 to 40 milliohms. Operating time is 0.5 millisec on make and 2 millisec on break.

Hamlin, Inc., Lake Mills, Wis.



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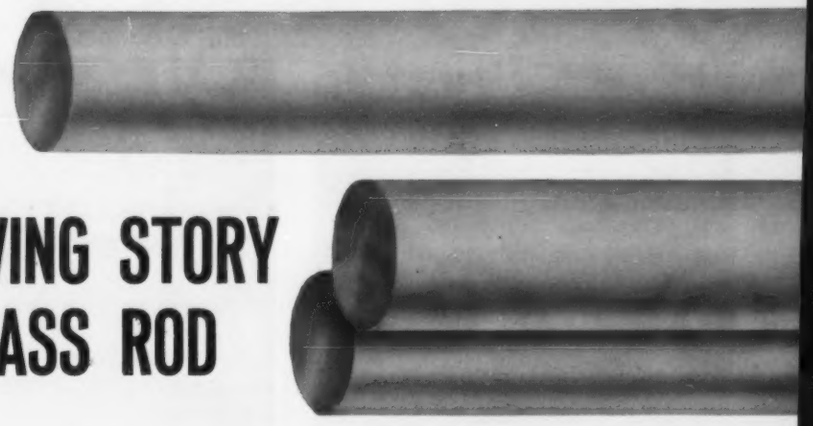
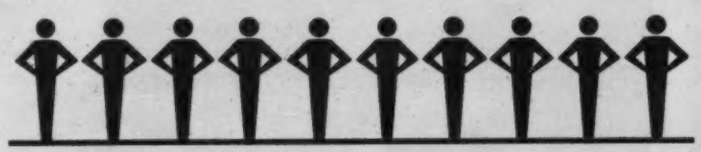
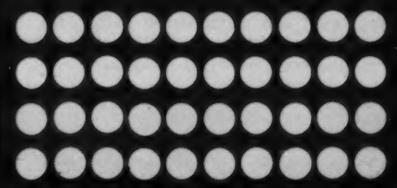


A GRAPHIC, MONEY-SAVING STORY OF REVERE BRASS ROD

BEFORE using Revere Brass Rod



10 INSPECTORS



REJECTS RAN AS HIGH AS 40%

AFTER using Revere Brass Rod

2 INSPECTORS

ONLY 6 REJECTS IN 30,000 PIECES

A prominent manufacturer of electronic gear was having difficulty with wafer-like brass discs used to maintain the fidelity of tone in its equipment. Rejects were running as high as 40% and a staff of ten inspectors was needed to keep tabs on these seemingly-minor parts.

Revere's Technical Advisory Service was called in for consultation with the manufacturer's engineers. Working together, they found the reasons for the high rejection rate . . . ordinary free-cutting brass rod from which the discs were cut, just couldn't do the job properly. Likewise they found the solution.

Rigid control of molecular structure of the alloy . . . "kid glove" treatment at the Revere mill . . . careful quality control all down the line . . . these produced a brass rod that cut the number of inspectors from ten to two and the rejects from as high as 40% to a startling low of six pieces in 30,000!

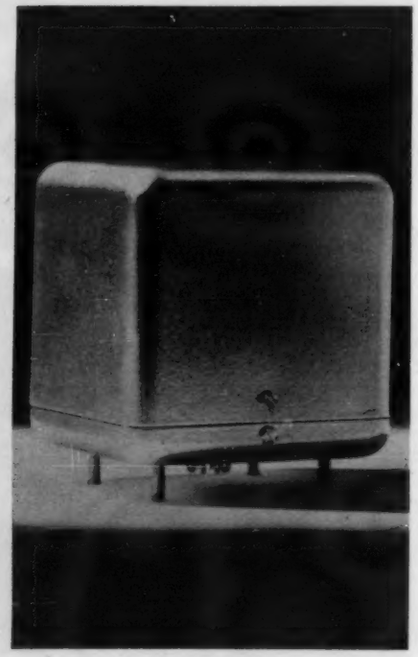
Although this rod has a premium price tag, such great savings per-unit are possible that even the most exacting purchasing executives have been unable to work out a better way to handle the problem.

This story is typical of the kind of savings that can be realized when you work hand-in-glove with your suppliers. It shows how higher first costs sometimes can be made to become lower final costs. Why not bring *your* metal problems to Revere for solution?

REVERE
COPPER AND BRASS INCORPORATED
Founded by Paul Revere in 1801
Executive Offices: 230 Park Ave., New York 17, N. Y.
Mills: Rome, N.Y.; Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles, Riverside and Santa Ana, Calif.; New Bedford and Plymouth, Mass.; Brooklyn, N.Y.; Newport, Ark.; Ft. Calhoun, Neb. Sales Offices in Principal Cities.
Distributors Everywhere

Sensitive Solid-State Relay 321

Output loads of as much as 250w continuous duty are controlled with only 0.25-microwatt control power in this solid-state relay. Switching is performed by a silicon-controlled rectifier driven by a magnetic amplifier. Snap-action is provided by a feedback circuit. The "ultRelay" automatically resets upon de-energization or lowering of the control power to drop-out level, which can be as low as 10 percent to provide positive switching. The switching level can be adjusted externally. The unit is housed in an anodized-aluminum



case, electrically isolated from internal circuitry and available with several standard basings. Isolation also is provided between load and control circuits. Absence of mechanical contact, bearings or moving coils allows a life in excess of one million cycles over an ambient temperature range from −20 to 160F. Size of the unit is 3 by 3-1/2 by 3-1/2 inches and weight is 2.2 lb maximum.

Airborne Accessories Corp., Industrionic Div., 5456 W. Washington Blvd., Los Angeles, Calif.

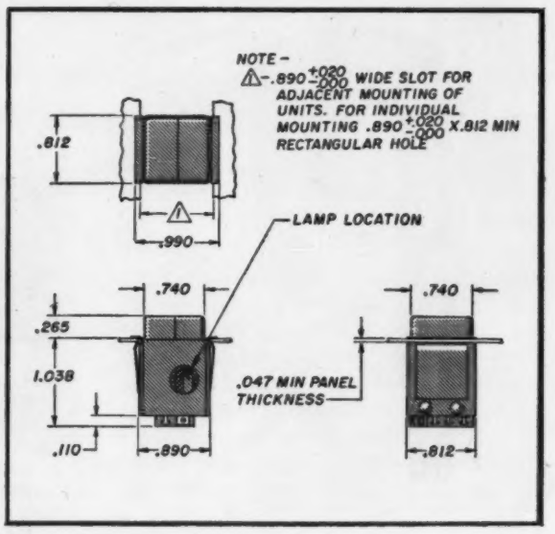
Reliable snap-action switches

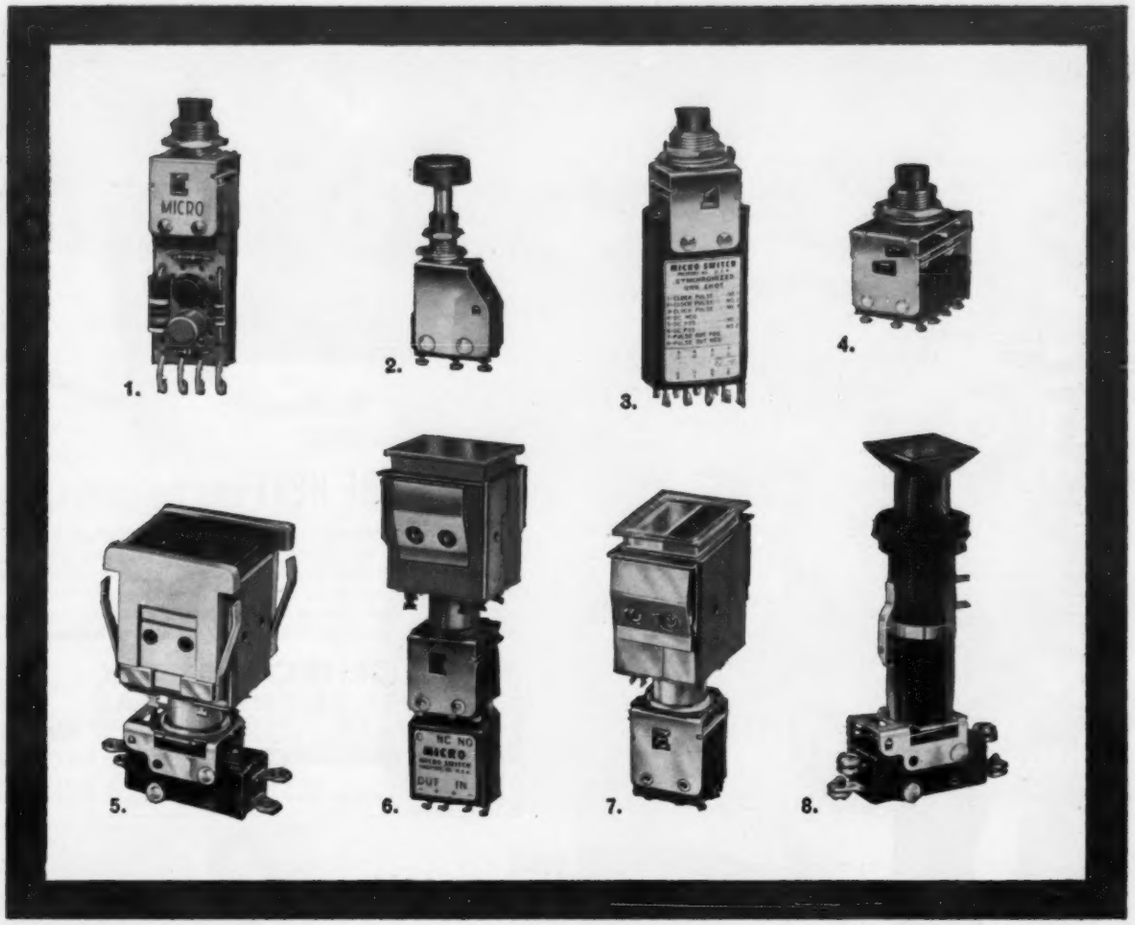
Here is a new concept in ultra-small lighted pushbutton switches for control with integral simultaneous visual indication. Switches in the "300" series are designed for military and industrial electronic control panels where space is an important factor.

In less than one cubic inch: double-pole double-throw switching; two integral lamps; choice of 15 combinations of two-color display screens. Alternate-action operation (push on—push off). Designed to conform to MIL-S-6743, MIL-S-6744, and MIL-E-5272.

Within the assembly are two SPDT switches, rated 7 amps. 115-230 vac or 28 vdc. A 5-volt sub-miniature lamp is under each half of display screen and there are 15 combinations of color display available. The complete unit snaps into panels 0.047 in. thick or greater. No installation tools needed. Minimum mechanical life is 100,000 operations. Lamp life is 60,000 hours at rated load.

Available in the same size are a momentary-action switch, and an indicator unit without switching function.





for electronic control panels

CUSTOM-BUILT CONTROL PANELS REQUIRE CAREFUL SELECTION OF SWITCHES

Immediately available are hundreds of small size switch units with variations in dimension, electrical capacity, shape, appearance and circuitry. All have undergone thorough tests in the most complete test laboratory of its kind.

Shown above and briefly described here are only a few of the hundreds of types of switch assemblies available.

1. Electronic switch-circuit for bounce-free voltage output.
2. Light force, rapid repeat pushbutton.
3. Synchronized "one-shot" pulse circuit.
4. Compact, 4-pole snap-action pushbutton.
5. Lighted pushbutton, modular design, barrier mount.
6. Lighted pushbutton, electronic "one-shot" switch-circuit.
7. Two-color lighted pushbutton, snap-in flange mounting.
8. Bushing mount lighted pushbutton, high capacity, 2-ckt switch.

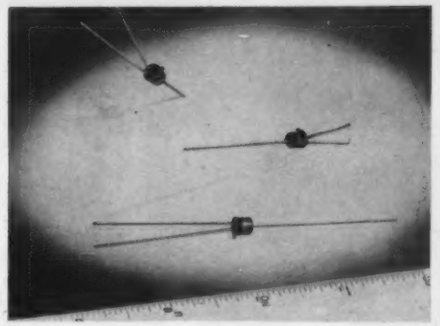
For more information and for experienced help in selection, contact one of our many branch offices listed in the Yellow Pages, or write for Catalog 67 and Bulletin 22.

MICRO SWITCH, FREEPORT, ILLINOIS
A division of Honeywell
In Canada: Honeywell Controls, Limited, Toronto 17, Ontario

H HONEYWELL **Honeywell**
MICRO SWITCH Precision Switches

Circle 40 on Reader-Service Card for more information

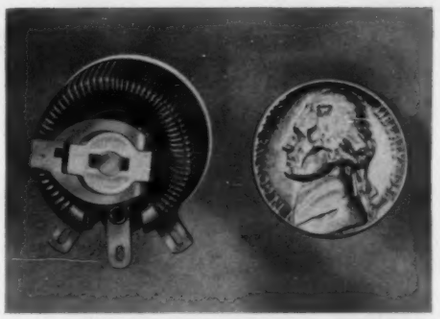
Subminiature Silicon-Controlled Rectifier 322



Silicon-controlled rectifiers now are manufactured in subminiature sizes. The small units have d-c ratings to 200v and 350 ma with a pulse capability to 10 amps, while requiring only 2 ma trigger. The subminiature units are obtainable both in conventional out-line and in in-line configurations for welded modules and printed circuits.

Solid State Products, Inc., One Pingree St., Salem, Mass.

Tapered-Winding Rheostat 323



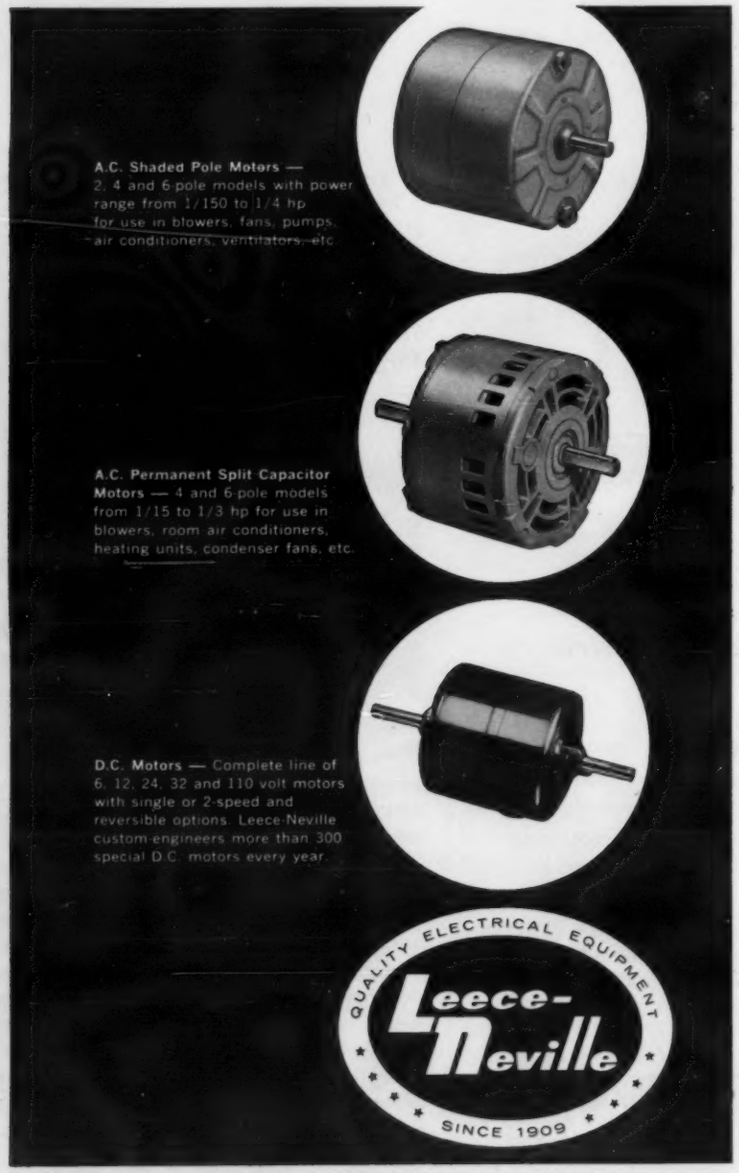
Although it measures 7/8 inch in dia and extends only 11/16 inch behind the mounting panel, the Model "E" rheostat will dissipate 12-1/2w. In addition to the high-power dissipation, the rheostats are available with customer-specified tapered windings. Advantages of the tapered windings are more linear control of some loads, higher maximum resistance values for a given current rating and production of specific resistance-versus-rotation curves. The rheostats feature ceramic hubs, independent contact-arm pressure, vitreous enamel coating and metallized graphite contact. Linear rheostats also are offered, with 23 stock sizes to 5000 ohms.

Ohmite Mfg. Co., 3645 Howard St., Skokie, Ill.

AC OR DC—FOR EFFICIENT, RELIABLE, LOW-COST POWER, SPECIFY LEECE-NEVILLE MOTORS

The world's largest independent supplier of fractional horsepower D.C. motors for automotive use also offers you a complete line of quality A.C. motors capable of meeting U.L. and C.S.A. application tests. Advanced design and modern manufacturing facilities assure peak performance and delivery to your schedules. Select a basic unit, let us help you adapt a basic unit, or we will custom-engineer a special motor to your requirements.

For information on A.C. motors, write The Leece-Neville Company, Dept. DN-11, Georgia Division, Athens Highway, Gainesville, Georgia. For D.C. motor data, write D.C. Motor Div., Cleveland 3, Ohio.

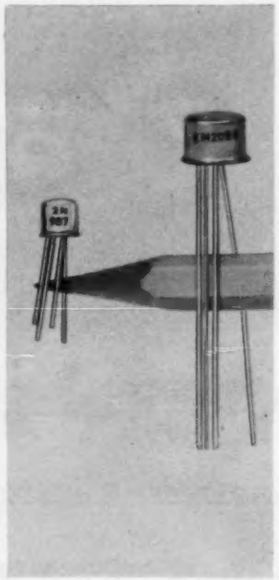

A.C. Shaded Pole Motors — 2, 4 and 6-pole models with power range from 1/150 to 1/4 hp for use in blowers, fans, pumps, air conditioners, ventilators, etc.
A.C. Permanent Split Capacitor Motors — 4 and 6-pole models from 1/15 to 1/3 hp for use in blowers, room air conditioners, heating units, condenser fans, etc.
D.C. Motors — Complete line of 6, 12, 24, 32 and 110 volt motors with single or 2-speed and reversible options. Leece-Neville custom-engineers more than 300 special D.C. motors every year.
QUALITY ELECTRICAL EQUIPMENT
Leece-Neville
SINCE 1909

Circle 41 on Reader-Service Card for more information

ELECTRICAL

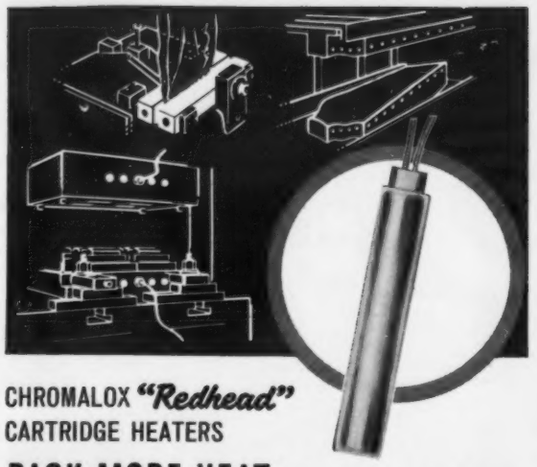
Universal Communications Transistor 324

A low-cost universal communications transistor, a 2N987 in the TO-18 case, and 2N2084 in the TO-33 case, is available for HF and VHF communications. The PADT germanium alloy-mesa transistor combines high breakdown voltage, high beta and high frequency for use in RF and IF amplifiers in mobile, airborne, instrumentation and radar IF applications. Typical



power gain is 14 db at 100 mc, beta (h_{fe}) of 140, breakdown voltage (BV_{cbo}) of 40v and an output capacitance (C_{ob}) of 2 MMF. The 2N987 is priced at $1.55, the 2N2084 at $1.25 each in 1000 lots. Sample and production quantities of the transistors are obtainable.

Amperex Electronic Corp., Semiconductor and Special-Purpose Tube Div., 230 Duffy Ave., Hicksville, L.I., N.Y.



CHROMALOX *"Redhead"* CARTRIDGE HEATERS

PACK MORE HEAT into the same space.

You just can't beat these rugged, highly efficient cartridge heaters for heating dies, platens, molds and similar types of processing equipment. You get up to 5 times more heat power than with standard cartridges. And because heat recovery is much faster you can step up your cycles. Chromalox "Redheads" are available in a wide range of diameters, lengths and ratings to give you the output to meet every spot-heating job. **Write for Bulletin PC101.**

CHROMALOX ELECTRIC HEAT
EDWIN L. WIEGAND COMPANY
7561 THOMAS BOULEVARD, PITTSBURGH 8, PA.
PROCESS COMFORT

Circle 42 on Reader-Service Card for more information

molded in one-piece.. 2 durometers

Drain Manifold 60 and 80 Durometer

Dual durometer process lets you combine hard-soft sections in one piece . . . with one-operation economy. Ask to see samples!

eliminates fabricating costs!
improves quality!
increases design flexibility!

GEAUGA INDUSTRIES CO.
A Subsidiary of Carlisle Corporation
MIDDLEFIELD, OHIO

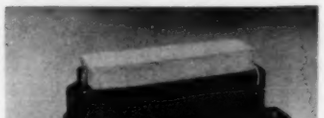
Circle 43 on Reader-Service Card for more information

Lamp Signals Burnout 325

Designed primarily for use as a signal or indicator, this twin-filament miniature lamp indicates the need for replacement. One filament supplies the major portion of the light output; the other is designed for long life. When the first filament burns out, the second still functions as an indicator but at reduced candlepower.

Chicago Miniature Lamp Works, Dept. DN-1, 1500 N. Ogden Ave., Chicago 10, Ill.

Sprayed-On Heating Elements 326



Temperature-control heating elements may be applied to flat, cubicle or contoured surfaces of any kind or size. The conductive and insulating coatings of the sprayed-on heaters are only 0.015 inch thick, allowing the heat to spread rapidly and evenly over all areas of the part being covered. The transistor oven illustrated has an internal temperature control maintaining an environment of 92C ±1C and with a watt density sufficient to provide initial temperature rise from as low as −45C to 92C in less than 15 minutes. In addition to its space-saving advantages, the total weight of the element and its insulation is only 0.07 lb per sq ft.

Electrofilm, Inc., 7116 N. Laurel Canyon Blvd., North Hollywood, Calif.

Circle 44 on Reader-Service Card

✻ ASCO MIDGET 3-WAY—ACTUAL SIZE

OVERSIZE EXHAUST

NORMALLY OPEN
NORMALLY CLOSED, OR
UNIVERSAL OPERATION

MOUNTS IN ANY POSITION

ONLY 2 MOVING PARTS

The ASCO Bulletin 8317 Solenoid Valve provides the fastest cylinder or diaphragm return of any valve its size. For example, at 100 psi a 12" return stroke in a 3" cylinder takes 2½ seconds with the 8317 . . . 7 seconds with a comparable valve. This remarkable 3-way solenoid valve can be substituted for larger, more expensive units normally required to obtain fast return.

In other 3-way valves, the fast rate of flow under pressure usually provides quick operation of the cylinder or diaphragm, but the dissipation of pressure on exhaust results in a slower return stroke. The large exhaust orifice on the Bulletin 8317 (over 7 times greater than the inlet area) quickly vents the pressure, permitting the piston or diaphragm to return rapidly.

The ASCO Bulletin 8317 has only 2 moving parts . . . mounts in any position . . . is available in normally open, normally closed and universal construction . . . with general-purpose, explosion-proof or watertight solenoid enclosures in ¼" pipe size . . . for pressures up to 160 psi . . . for water up to 100° F. or air, gases and light hydraulic oil up to 180° F. It is immediately available from stock, as are other ASCO solenoid valves.

WRITE FOR BULLETIN 8317, providing complete descriptive information on this new, "midget," quick-exhaust 3-way.

ASCO Valves ASCO®

DEPENDABLE CONTROL BY Automatic Switch Co. 56-D HANOVER RD., FLORHAM PARK, N. J. • FRONTIER 7-4600 • AUTOMATIC TRANSFER SWITCHES • SOLENOID VALVES • ELECTROMAGNETIC CONTROL

MEEHANITE MEANS BETTER CASTINGS®

Standard construction materials for all Blackmer Vari-Flo pumps is high strength, pressure-tight Meehanite Nodular Iron. It provides the necessary mechanical properties and is less costly than steel, particularly from the standpoint of machining. The intricate rotor shown, a critical internal part subject to high stresses, is cast in type SP-80 to insure top performance under the most severe service conditions.

SOLVE YOUR TOUGH CASTING PROBLEMS WITH MEEHANITE NODULAR

The excellent castability of Meehanite Nodular in combination with exceptional strength, ductility and wear resistance has led to its wide acceptance for intricate pressure castings and many other components which must withstand severe service conditions. The broad range of its utility is further enhanced by inherent production advantages resulting in a reduction of manufacturing costs.

Meehanite Nodular is available in a broad range of properties embracing all current Nodular specifications and including some unique new wear and heat resisting types. When you specify one of the S types of Meehanite Nodular, you can be sure of obtaining castings that live up to specified claims. Meehanite foundries have more than a quarter of a century of experience in handling the essential materials used to convert the graphite in cast iron from the flake form to the nodular which gives this family of metals its unique engineering properties. Meehanite patented quality controls assure uniform dependability regardless of how small or how large the casting.

For complete information about Meehanite Nodular, send for a free single copy of our eight page brochure (B-47-A). Write: Meehanite Metal Corporation, 714 North Avenue, New Rochelle, New York.

MEEHANITE METAL

MEEHANITE CASTINGS ARE MADE ONLY BY MEEHANITE FOUNDRIES.

Circle 45 on Reader-Service Card for more information

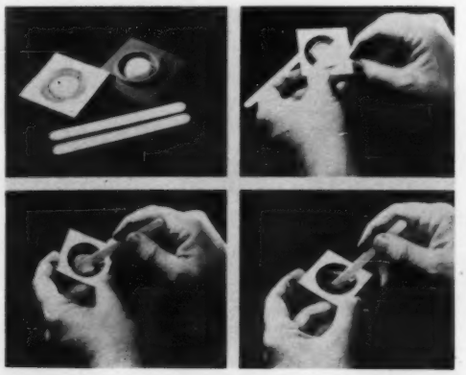
Metal Foils with 'Teflon' Coat 327

Copper or aluminum foils ranging from 0.005 to 0.0002 inch thick now can be supplied with a coating of "Teflon" from 0.0006 to 0.005 inch thick. The foils are expected to be used in electrical equipment as a mold release or as a very thin high-temperature gasket material. Also introduced is a laminate said to be the thinnest, most flexible printed-circuit material now available. It has an operating temperature over 300F. Made of a 1-mil thickness of matted submicron glass fibers with a 3/4-mil thickness of copper, the thin flexible printed-circuit material has been used to produce an ultrasensitive strain-detection device.

American Machine & Foundry Co., Amflex Products Dept., AMF Bldg., 261 Madison Ave., New York 16, N.Y.

Epoxy Mixer Package 328

Catalyst and resin are sealed in a polyethylene container—one component in a central dish, the other in a separate concentric ring. The polyfilm cover of the "PA-KIT" is pealed back and a stirring stick is used to push down the center of the container, collapsing the outer ring and merging



its contents with the central dish. The resin and catalyst, of contrasting colors, then may be mixed directly in the package, furnishing a visual indication of an even mixture. The container holds 1/10 oz of epoxy cement and is thrown away after use.

Plastic Associates, Box 36, Laguna Beach, Calif.

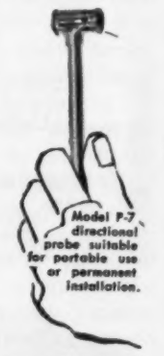
HASTINGS AIR METERS

FOR HIGHEST ACCURACY

From the very low speed flow of air in agricultural research—to the balance of flow in heating and air conditioning installations—to the measurement of air speed for missile testing—the accuracy and rapid response of HASTINGS Air Meters sets the standard. These are but a few of the wide variety of applications where HASTINGS instruments measure the flow of air—as low as 5 fpm—as high as 200 mph. HASTINGS Air Meters, with patented heated thermopile compensated for temperature and rate of change of temperature, are specified for maximum accuracy, stability, response.

• Model B Air-Meter is a dual-range, individually calibrated, highly accurate instrument. Provides for use with recorder. 4" indicating and 4" current set meter for continuous calibration check. Range 0-20,000 fpm (or 200 mph on special order). Switching unit for multi-probe operation available. Available with directional or non-directional probes.

• *Hand-Portable Model G* with expanded scale provides excellent readability in low ranges. Compact design. No moving parts to break down or require maintenance. Battery operated power pack available as accessory. Range 0-6000 fpm.



For more detailed information on these or other air meter instruments, write for Catalog No. 400.

HASTINGS-RAYDIST, Inc.

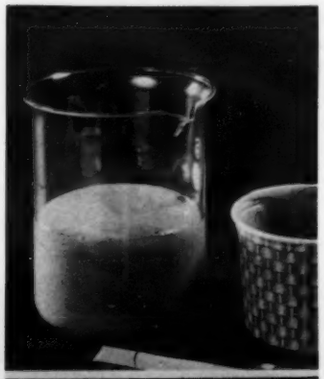
Hampton, Virginia PArk 3-6531

Circle 46 on Reader-Service Card

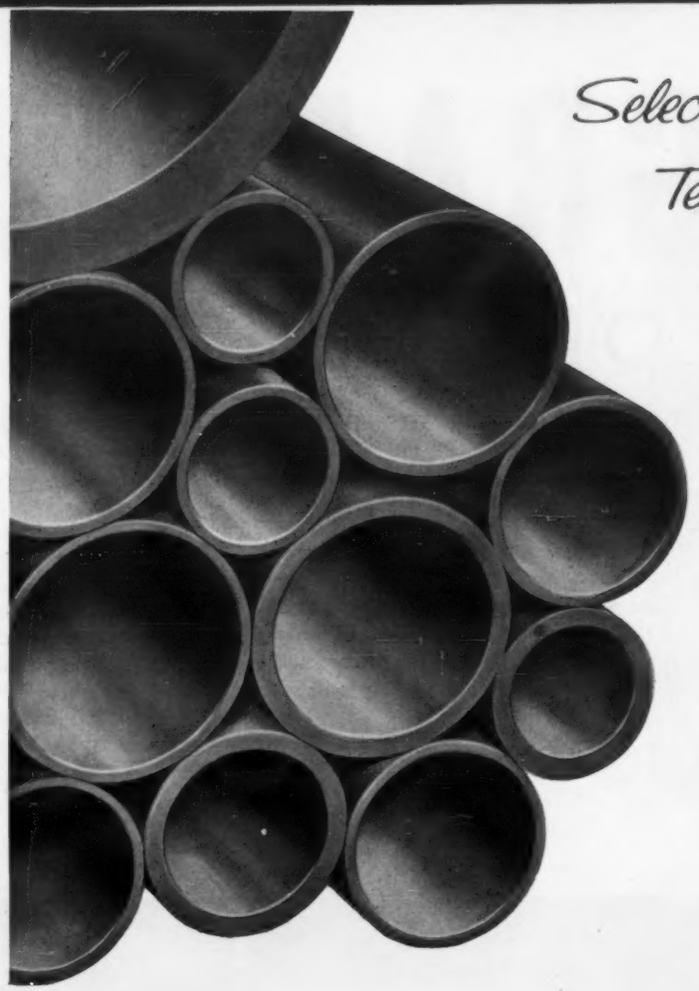
Silicone Rubber Foam **329**

In only 4 to 5 minutes after addition of the catalyst, this room-temperature curing silicone rubber expands seven times in volume. "Silastic RTV S-5370" produces a foam having 10-percent closed-cell structure and a density of 10 lb per cu ft. The catalyzed fluid pours easily before the foaming reaction is completed, allowing it to flow into place. The material is serviceable from −70 to 500F and shows good electrical properties.

Dow Corning Corp., Midland, Mich.



Circle 47 on Reader-Service Card



Selection of finest raw materials

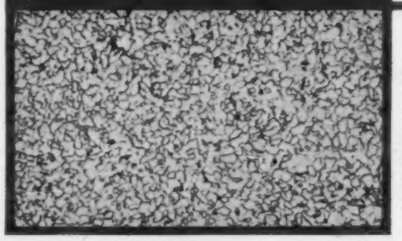
Testing every step of the way

Inspection to rigid standards

Assure 100% dependability for

OHIO WELDED PRESSURE TUBING

Photographs show flare, flattening and crush tests performed continuously on every order. Non-destructive tests include air, water, magnetic, eddy current and visual inspection to insure 100% dependability.



Photomicrograph of polished and acid-etched surface shows perfect microstructure of normalized Ohio Welded Pressure Tubing. Weld area running down the center is now indistinguishable and tube has become, in every sense, weldless.

You can be sure — doubly sure — of utmost tubing dependability when you specify Ohio Welded Pressure Tubing — *made by Ohio Seamless.* First, Ohio works to accepted industry standards — ASTM, ASME, and similar Federal and military specifications covering welded pressure tubing. Second, Ohio Welded Pressure Tubing is produced under a *continuous* process of quality control — not just a final test inspection to cull questionable material.

Carefully selected prime raw material is slit, edged, shaped and electric resistance welded on the most versatile and modern equipment in operation. At each and every step of the way Ohio Welded Pressure Tubing is under the scrutiny of Ohio's master tubemakers . . . making control tests at frequent intervals . . . testing random samples from each production order far beyond the limits of the usage involved.

For critical pressure piping applications . . . for condensers, heat exchangers, boilers and superheaters — in the range of sizes from ½ to 7½" OD and wall thicknesses from .028 to .375"— mark your prints "*Ohio Custom Made Welded Pressure Tubing.*" There is no equivalent.

OHIO

OHIO SEAMLESS TUBE

Division of Copperweld Steel Company

SHELBY • OHIO

Seamless and Electric Resistance Welded Steel Tubing • Fabricating and Forging

Representatives in principal cities. Check leading directories:
THOMAS', MacRAE'S, CONOVER-MAST, SWEET'S, FRASER'S.

A-4800A

Waterproof Adhesive 330

Vinyl-lined swimming pools now may be patched without emptying all the water by the use of this adhesive. Called "Vinyl-Anchor", the material is applied to a vinyl patch and, while wet, placed in contact with the tear even though it may be under water. The material is also good for adherence of "Plastisols" and "Organisols" containing a large amount of plasticizer. The adhesive film is resistant to water, oil and aromatic fuels. It is available in 55-gal drums and in 1- and 5-gal containers.

Anchor Adhesives Corp., 36-23 164th St., Flushing 58, N.Y.

Tungsten Disulfide Lubricant 331

Tungsten disulfide is a synthetically produced, soft, gray-black powder having high oxidation resistance and lubricating properties. The material has the ability to form soft, adherent, continuous films on surfaces and exhibits lubricating properties similar to molybdenum disulfide or graphite. It has greater oxidation resistance than these other materials. For example, after two hours' exposure in air at 427C, tungsten disulfide loses only 1.2 percent of its sulphur content, whereas molybdenum disulfide loses 77 percent of its sulphur content under the same conditions. The material can be used in solid-film form or as an additive with suitable carriers, as a lubricant in wire drawing, metal forming, cutting, working or in valves, gears and bearings.

Sylvania Electric Products, Inc., General Telephone Bldg., 730 Third Ave., New York 17, N.Y.

Circle 48 for Reader Service

GRAPHITAR®

(CARBON-GRAPHITE)

FOR PERFORMANCE

Superior performance and unusually long service life, even in tough applications, is practically second nature to parts made of GRAPHITAR. That's because they combine GRAPHITAR's chemical stability, heat resistance, low coefficient of friction, adaptability to self-lubrication, mechanical strength, hardness and light weight. An everyday application of GRAPHITAR that illustrates well its versatility and remarkable performance can be found in the face-type valves employed in bulk station gasoline meters.

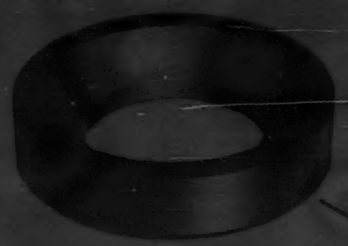
These valves incorporate GRAPHITAR seats. Here, GRAPHITAR's corrosion resistance, chemical inertness and resistance to expansion or contraction under rapid temperature changes, allow the valves to provide a leak-tight seal with excellent wear characteristics. These same characteristics are necessary for good performance wherever steam, gas and chemicals must be handled under the most adverse conditions. Perhaps your product can benefit from the top performance of GRAPHITAR, a unique and versatile engineering material.

Comparative testing of various grades of GRAPHITAR self-aligning seals is accomplished on this equipment, which duplicates actual operating conditions. GRAPHITAR rotary pressure joint seals such as these often operate at 400 psi, at 650°F. and at rotary speeds of 600 ft/min.

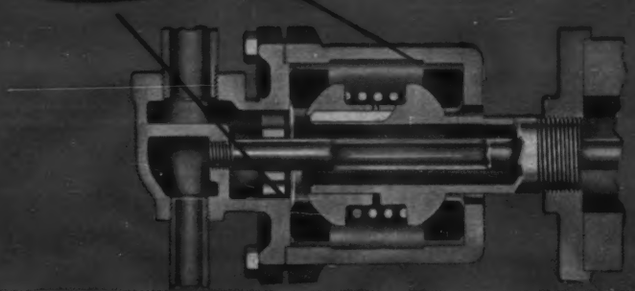
Tests show that the compressive strength of GRAPHITAR grades varies from 4,500 to 45,000 psi. Correct part design can take advantage of this desirable characteristic to aid part performance.

GRAPHITAR's corrosion resistance and ability to withstand rapid temperature changes allow valve seats to provide efficient and dependable sealing in gasoline meters. Parts operate under 50 psi at 100 ft/min . . . and from 150 degrees F. to —70 degrees F.

Running directly in the gasoline reservoirs below ground level, a submersible, explosion proof pump depends on two GRAPHITAR bearings to keep its operation safe and smooth. GRAPHITAR is non-metallic, will not weld or score even when in contact with a dry metal shaft. Because GRAPHITAR operates with *any* liquid as a lubricant, it is an ideal bearing material wherever low viscosity liquids such as gasoline are encountered.



Self-aligning seals of GRAPHITAR are employed in rotary pressure joints handling steam, water, hot oil, trichlorethylene, powdered talc and a variety of chemicals. GRAPHITAR has the ability to withstand the action of many such chemicals and only very highly oxidizing reagents in hot and concentrated form can react to destroy GRAPHITAR.



GRAPHITAR is a material uniquely designed by its nature for solving tough problems and improving processing, and it can be further custom-engineered to meet your exact specifications. For complete information on GRAPHITAR . . . send for Engineering Bulletin #20.

THE UNITED STATES GRAPHITE COMPANY

DIVISION OF THE WICKES CORPORATION, SAGINAW 2, MICHIGAN

GRAPHITAR® CARBON-GRAPHITE • GRAMIX® POWDER METALLURGY • MEXICAN® GRAPHITE PRODUCTS • USG® BRUSHES

Self-Closing Gasket 332

Latching mechanisms are no longer needed on refrigerator doors using this magnetic polyvinyl gasket material. While first introduced in 1960, this flexible magnetic material now has greater magnetic power. The unusual seal is offered in eight different cross-sections, allowing a wide variety of uses. Special sizes and special magnetic hole patterns are obtainable on special order.

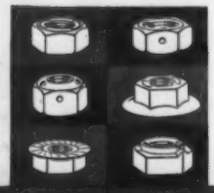
B. F. Goodrich Co., Plastic Products, Oak Grove, Marietta, Ohio.

Epoxy Resin Diluent 333

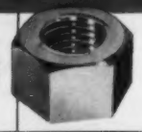
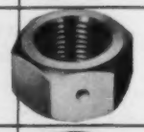
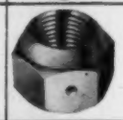
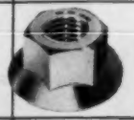
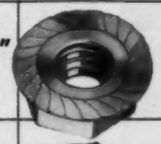
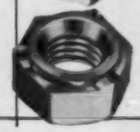
This material is a nontoxic epoxy-reactive diluent which reduces the viscosity of liquid epoxy systems. Agent AT-534 demonstrates its ability to reduce visosity while contributing formulating and end-property advantages, such as improved impact resistance. The high-boiling, odorless liquid reacts readily with epoxy-curing agent admixtures, without any appreciable effect on the rate of cure or gel, even at room temperatures. The agent will not react with an epoxy resin in the absence of a curing agent, permitting long storage under normal conditions. The material will form adducts with aliphatic polyamine curing agents capable of curing epoxy resins at room temperature and also will solubilize aromatic polyamines, forming compounds readily soluble in epoxy resins, eliminating elevated-temperature mixing. The diluent has exhibited a high margin of safety determined through both toxicity tests and history of use.

Antara Chemicals Div., General Aniline & Film Corp., 435 Hudson St., New York 14, N.Y.

Circle 48 for Reader Service

One  of these
CAN IMPROVE YOUR PRODUCT...

SIX GREAT
MACLEAN-FOGG
LOCK NUTS

MF **UNI-TORQUE**		A free starter with lock at the top. Withstands severe vibrations. Cuts assembly time.
MF **TWO-WAY**		The Lock's in the center of nut. Can be applied from either end. Permits bolt end to be flush with, or below, top of nut.
MF OPEN END **CAP NUT**		Has two-way center-of-nut lock. Used on furniture, appliances, toys, lawn mowers, tools, etc.
MF UNI-TORQUE **FLANGE NUT**		Combination lock nut and washer. Use on oversized holes; where extra bearing surface is needed.
MF **"WHIZ-LOCK"** FLANGE NUT		This one spins on. Serrations take a firm grip on work. Break loose torque higher than seated torque.
MF PILOT TYPE **WELD NUT**		You can have it with or without lock. Simplifies assemblies by means of self-locating pilot.

CIRCLE NUMBER FOR ILLUSTRATED CATALOG

MAC LEAN-FOGG LOCK NUTS

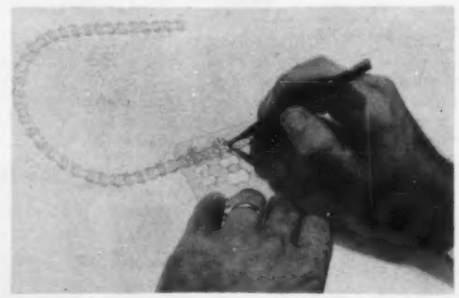
MacLean-Fogg Lock Nut Company
5535 N. WOLCOTT AVENUE
CHICAGO 40, ILLINOIS

FOR ALL YOUR LOCK NUT NEEDS

Circle 49 on Reader-Service Card for more information

EQUIPMENT

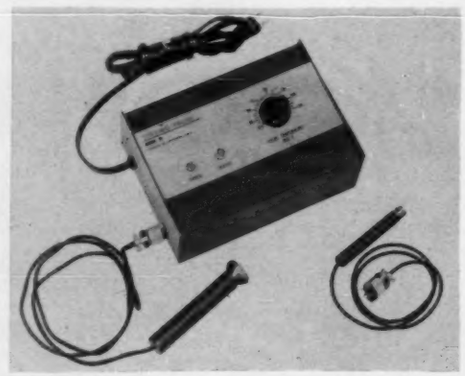
Roller-Chain Template 334



Drawings including chain detail may be made quickly and easily with the Model CT-613 transparent plastic template. Centers are provided for 1/4-, 3/8-, 1/2- and 5/8-inch chains. Overall size is 2-1/2 by 5-1/8 inches.

JadKo Corp., 1050 Laskey Rd., Box 6714, Toledo 12, Ohio.

Component Heater 335

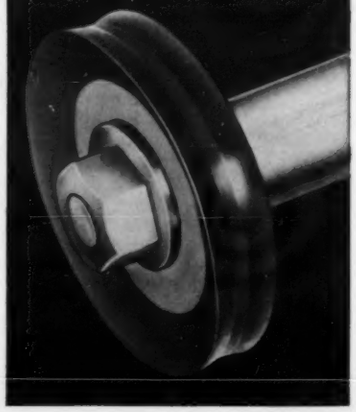


This device permits temperature-testing of circuit and components including power transistors and subminiature diodes. A heated probe fits the component to be tested and the temperature is set on the unit. Temperature stability is ±0.5C—the temperature may be set within ±3C. Two interchangeable probes are supplied, one with a 35w heater, the other with a 9w heater. The tips supplied with the unit fit the standard TO-3 and TO-5 transistor cases. Special tips to fit other transistor sizes or a wide variety of other components may be obtained.

Kennedy Co., 2029 N. Lake Ave., Altadena, Calif.

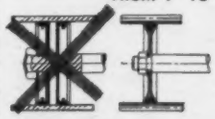
REDUCE COSTS, IMPROVE PRODUCT QUALITY!
use
CHICAGO-ALLIS

ONE-PIECE DOUBLE ACTING PISTON CUPS



For cylinders, pumps, and valves ... air, water, or oil. This is a piston type double-cup packing in a single unit... specially compounded rubber is bonded to metal disc of brass plated steel or solid brass. Lips are designed to maintain uniform pressure on the cylinder walls, insuring constant sealing action. Serving the same purpose as far more complicated and expensive pistons, Chicago-Allis piston cups are simple in design, economical, and provide long life and dependable service.

STOCK SIZES AVAILABLE FOR CYLINDERS FROM 1" TO 12"



Simplify design... use one piston type cup that replaces piston and two seals

Write today for Bulletin 108

CHICAGO-ALLIS
MFG. CORP.
129 N. GREEN ST. CHICAGO 7, ILL.

Circle 50 on Reader-Service Card

Dual-Band Radar Receiver 336

Designed to be clipped to a sunvisor or mounted on a dashboard with its magnetic base, this traffic radar receiver emits an audible warning whenever it intercepts a radar beam within a 1/2-mile range. The device is completely transistorized and operates on an internal, self-testing battery. Measuring 3-5/8 by 2-1/4 by 3-1/4 inches, the receiver weighs only 13 oz and is available in a choice of beige, sapphire blue or emerald green. Cost is $39.95 postpaid.

Radatron, Inc., 232 Zimmerman St., North Tonawanda, N.Y.

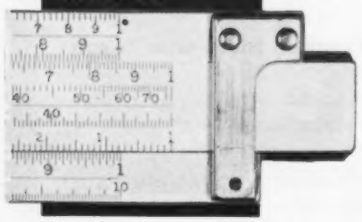
Miniature Transistorized Preamplifier 337

Gain of laboratory instruments or the output of transducers may be increased by a factor of 100 with this miniature preamplifier. Measuring 1-1/4 by 1-1/2 by 2-1/2 inches, including self-contained battery, the device has a 3-db bandwidth from 1 cps to 1 mc. The amplifier noise-level is less than 3 microvolts with the input shorted. Input resistance is 100K and input capacitance is 20 MMF. At 1 kc, maximum output without clipping is 8v peak. Output to peak impedance is 100 ohms.

Ad-Yu Electronics Lab., Inc., 249-259 Terhune Ave., Passaic, N. J.

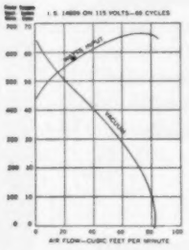
Circle 51 on Reader-Service Card

Fractional Horsepower Motors



Lamb® Helps You Select The Right Vacuum Cleaner Motor

9/16 HP, 5-11/16" fan case diameter



IS-14750 thru ventilated

APPLICATION: Domestic portable cleaners.

IS-14809 by-pass ventilated

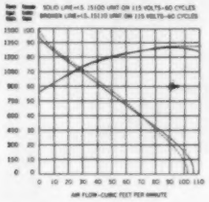
APPLICATION: Wet pick-up portable cleaners and central cleaning systems.

Service Life: Moderate
Cost: Low
Bulletins 101 & 201

NEW

1 HP, 7-3/16" fan case diameter

APPLICATION: Central vacuum systems in particular, also portable commercial wet and dry cleaners.



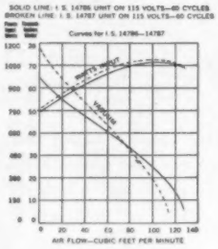
IS-15100 Diffused air discharge

IS-15110 Single air discharge

Service Life: Moderate
Cost: About twice cost of 9/16 HP
Bulletins 251 & 252

7/8 HP, 7-1/2" fan case diameter

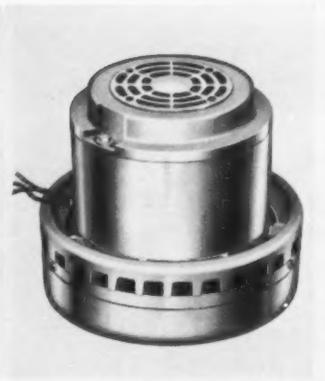
APPLICATION: Portable Heavy Duty Commercial Cleaners and Central Systems (three-stage).



IS-14786 2-Stage

IS-14787 3-Stage

Service Life: Long
Cost: About 3 times cost of 9/16 HP
Bulletin 301



IS-15100 (Diffuser Discharge)

IS-15110 (Single Air Discharge)

Special Requirements of Central Vacuum Systems Met by New High Performance Motor

Existing vacuum motors have been designed to perform best when incorporated into portable vacuum cleaners of standard types and sizes. Such motors are built to produce highest efficiency under air flow conditions that exist in normal domestic and industrial cleaning service and where hoses are of normal length and diameter.

On special applications, like central vacuum cleaning systems that utilize extremely long cleaning hoses, and where tubing losses are present, a special motor is required. To meet this need, Lamb now offers a vacuum motor which will maintain a relatively high vacuum with a modest amount of air flow. The result: these motors operate at high efficiency in the high vacuum range without sacrificing air flow performance under low vacuum conditions.

INPUT – 10 AMPERES at 115 VOLTS

For economical, cleaner design, this rating at Underwriters' test point was selected as the input limit. This allows use of line cord not exceeding number 16 type SJ and control switches of 10 ampere rating.

NEW TAPERED BLADE DESIGN

On central systems which employ centrifugal dirt separation, a small amount of fine dirt and lint must pass through the fan and is discharged outside of the building. For maximum efficiency, this type of fan blade is designed with a long backward curving sweep which, however, may accumulate fine dirt due to centrifugal action. This dirt builds up to a point where starting acceleration dislodges dirt from one blade, resulting in unbalance, noise, and vibration. Special steep angle blades have been used but they also have serious performance limitations.

Lamb research has developed a moderately steep blade angle plus a tapered form. The result is a compromise that yields excellent performance and all but eliminates the dirt loading problem.

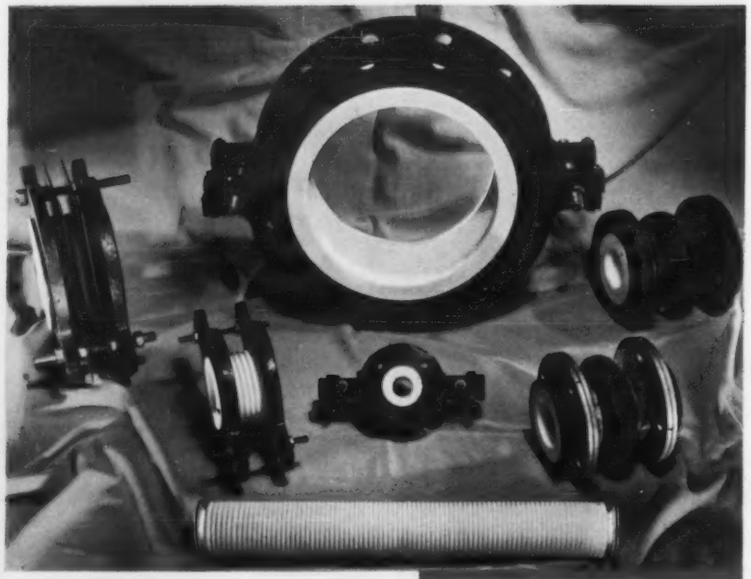
CHOICE OF AIR DISCHARGE SYSTEMS

Lint accumulation is minimized and high vacuum is improved in the IS-15110 with a single tangential discharge pipe. This allows for easy connection to a discharge piping system, if desired.

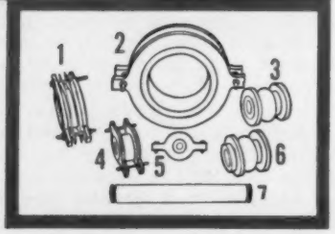
The IS-15100, by discharging air through slots in the fan case, results in better noise suppression.

FAN-END BEARING IS PROTECTED BY AIR COOLING

Motors in central vacuum systems are often required to operate for long periods of time under sealed conditions – which results in a high temperature rise in the fan system. In ordinary by-pass type motors, the electrical parts have a separate cooling system, but bearings in the adjacent fan case often become hot enough to destroy the lubricant. Early failures can and do result. Lamb's new motor prevents this by providing a unique ventilating system which directs cooling air over the fan-end bearing and protects the motor from harmful heat built-up within the fan case. For complete details, write to Lamb Electric Company, Kent, Ohio – ask for bulletins shown at left. *Also available – explosion-proof model. Ask for bulletin 401.*



What Size Teflon Bellows Do You Need?



Twenty-six inch IPS? One inch or any size in between? Flanged or plain end? Teflon* with or without a reinforcing cover? Full vacuum or pressures to 500 psi?

Whatever your requirements, Doré has the experience, the design and engineering skill plus the modern facilities to produce bellows to your specifications.

All Doré bellows are precision machined from specially processed, un-oriented Teflon. Their performance and dependability have been proved in the field, and in the laboratory where a Style E-8-F bellows has been flexed in excess of 5 million cycles.

To assist you in designing more efficient fluid handling systems, write for our new Bulletin B-61, containing specifications, dimensions, types, sizes and temperature/pressure nomographs for Doré bellows.

*Registered Trademark of E. I. Du Pont Co. for their fluorocarbon resins including TFE resins.

1. **Style E-8-NM, 4" pipe size.** Teflon bellows, with rubber and duck covered Teflon convolutions, external metal supports and split type ASA 150# flanges. 160 psi rating @ 200°F.

2. **Style E-8-F, 10" pipe size.** Teflon bellows, without covering, for maximum movement and flexibility. Split type ASA 150# flanges. 30 psi rating @ 200°F.

3. **Style E-8-W, 2" pipe size.** An economical high pressure Teflon bellows laminated with rubber, duck and steel wire. Furnished with galvanized steel back-up rings. 200 psi rating @ 200°F.

4. **Style E-8-F, 2" pipe size.** Rounded convolutions (machined) minimize stress concentration. Withstands 75 psi @ 200°F.

5. **Style E-8-S, 1" pipe size.** Flexible coupling commonly used as a vibration dampener, has no covering. 125 psi rating @ 200°F.

6. **Style E-8-D, 2" pipe size.** Covering consists of rubber, duck and steel wire mesh. Internal steel delta rings produce maximum sealing with minimum bolt torque. 500 psi rating @ 200°F.

7. **Special style E-8-F, 1½" pipe size by 18" in length.** Special bellows can be produced for your specific applications.

John L. Doré, Co.

5406 Schuler • P. O. Box 7772 • Houston 7, Texas
Export: 1505 Race St. Philadelphia 2, Pa. U. S. A.
Cable address: Dorex

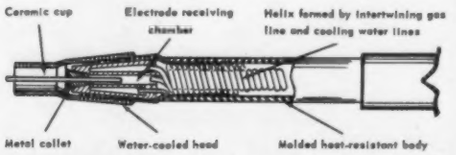
Du Pont TEFLON Doré FLUOROGREEN®

Fluorogreen is a John L. Doré Co. Reg. Trademark

Circle 52 on Reader-Service Card for more information

EQUIPMENT

Flexible Inert-Gas Torch 338



This tungsten-electrode inert-gas welding torch can be bent to almost any desired angle. The flexibility of the head is achieved by the helical winding of the copper gas and cooling-water lines. This makes a rigid yet flexible core which is brazed to the cooling head. The assembly then is molded and bonded with neoprene into a flexible, insulated, heat-resistant unit. This unit is inserted into a "Textolite" handle suitable for manual or machine use. A ceramic cup which centers itself

around the tungsten electrode is pressed over the upper portion of the sheath. Although it weighs only 3 oz, the torch is rated to 180 amps, a-c or d-c continuous duty, and to 300 amps a-c or d-c for intermittent duty. The torch will eliminate the need of stocking several head angles or lengths (according to the manufacturer).

Falstrom Co., Falstrom Court, Passaic, N.J.

Mobile Radio Frequency Meter 339

This frequency meter requires no accessory instruments, headphones, compensation charts or computations for measurement in the three mobile radio bands. Its sensitivity allows measurement of even the smallest hand-carried transistorized transceiver. Operation is a matter of peaking four meters and reading the frequency directly in the five readout ports. The entire procedure is said to require only a half minute.

Measurements, Div. of McGraw-Edison Co., Boonton, N.J.

in the best of circuits

use
HOLLINGSWORTH
SOLDERLESS
TERMINALS

because they

- SPEED PRODUCTION
- CUT ASSEMBLY COSTS

. . . all types . . . all wire sizes

- FAST DELIVERY
- GOVERNMENT APPROVED

SEND FOR CATALOG AND SAMPLES
SOLDERLESS TERMINAL DIVISION

hollingsworth
COMPANY
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Circle 53 on Reader-Service Card

NEW
CHIKSAN
LFS SERIES
SWIVEL JOINTS
Rated – 500 psi CWP
● Equally effective on water, hydraulics, fuels or gas lines. Sweep radius minimizes flow turbulence. Bearings are factory lubricated—sufficient, in normal services for the life of the joint. Fabricated from carbon steel. Temperature rating of 225°F—up to 400°F with Viton A packing. Size range is 1½" to 4". For more information, request Bulletin 11-60.
CHIKSAN COMPANY BREA, CALIF.
61-58 A

Circle 54 on Reader-Service Card for more information

manufacturing and designing of electronically welded products from plastic film and sheeting

Fabrico, a pioneer in the production of specially designed products from plastic film and sheeting, is in a particularly strategic position to fill your needs. Specialists in the handling, designing, heat-sealing of these materials, Fabrico's experience and know-how are your guarantees of complete satisfaction.

MAY WE ASSIST IN THE DEVELOPMENT OF YOUR PRODUCT?

"INDUSTRIAL FACT-FOLDER" FREE! . . . on industrial applications of plastic film and sheeting. ***WRITE TODAY!***

Fabrico Mfg. Corp.
1714 W. Division St., Chicago 22, Ill.

Circle 55 on Reader-Service Card for more information

Miniature Iron 340

The overall length of 5-7/8 inches for this 115v soldering iron allows a distance of less than 2 inches from hand to work—so close that the soldering may be performed like writing. The 12w device has an iron-coated tip 1/32 inch in dia and is available in many different point shapes. Tips of 1/16 and 1/8 inch also may be obtained. Working temperature is reached in less than 2 minutes but the handle remains cool through a ventilated design and a concave stainless-steel mirror that reflects heat from the operator's hand.

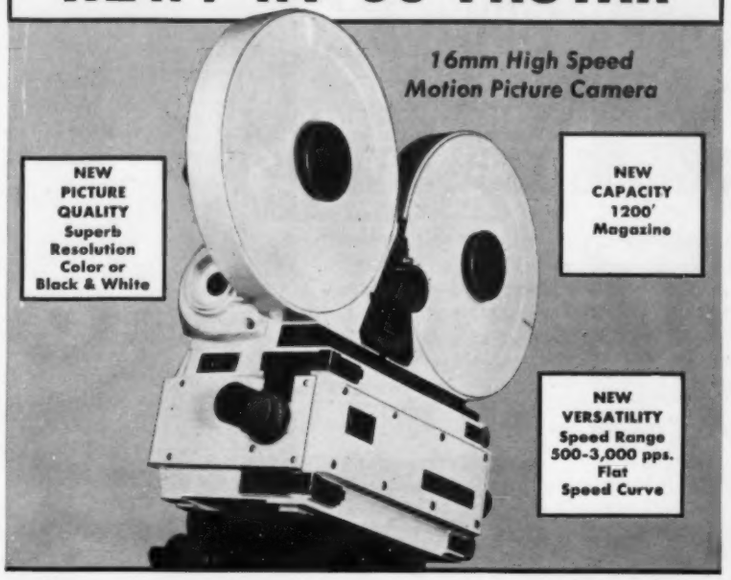
Hexaçon Electric Co., 636 W. Clay Ave., Roselle Park, N. J.

Disposable Gloves 341

Made of "soft-formulation" polyethylene plastic, these disposable gloves have more flexibility, extra toughness, touch sensitivity and comfort than older models made with standard polyethylene. Each glove is lightly mounted on a paper backing and packaged 72 to a box in wall-dispenser cartons. The gloves will fit either hand and furnish protection against chemicals, powders, encapsulating resins and their activators.

Wilson Rubber Co., Industrial Div., 1200 Garfield Ave., S.W., Canton 6, Ohio.

NEW! WF-30 FASTAX



Years Ahead in Design and Performance

A high speed camera with large film capacity . . . with a variety of speed ranges and high resolution has long been wanted by industry, the military and the government. The FASTAX WF-30 fills all these requirements and more. Darkroom loaded, "T" core, the magazine holds sufficient film for most studies. Camera versatility is another key feature. Variable speed range, controlled by a solid state loop servo device . . . rapid acceleration with flat speed curve within ±4% selected rate . . . start-stop capabilities. Superb resolution over entire frame results from excellent lens system and a sector shutter between rotating prism and focal plane.

WRITE for complete information and prices on WF-30 . . . the newest FASTAX in the wide line of Wollensak high speed motion picture cameras.

WF-32
OSCILLOGRAPHIC
RECORDER

Wollensak AN AFFILIATE OF 3M COMPANY
850 Hudson Ave. • Rochester 21, N.Y.
MINNESOTA MINING AND MANUFACTURING COMPANY

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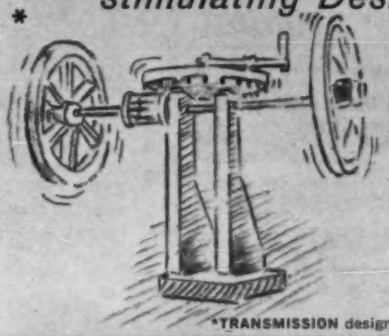
Design News

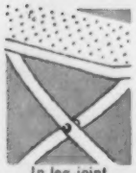
stimulating Design Activity through . . .



USABLE DESIGN IDEAS

*TRANSMISSION designed by LEONARDO DA VINCI, 1452-1519

Use it as a hinge pin... SEL-LOK spring pin

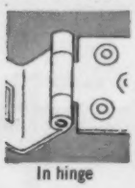


In leg-joint of ironing board

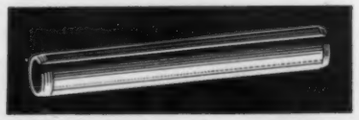
- Swift fastening—just drill and drive
- Secure locking—won't work loose despite shock or vibration
- Eliminates costly tapping, reaming, peening, milling
- Can be reused repeatedly
- 101 uses—as keys, cotter pins, axles, hinge pins, wrist pins, stop pins, pivots, etc.

On valve handle

SEL-LOK spring pins are available in carbon and corrosion-resistant steel (from 1/16 x 3/16 through 1/2 x 4 in.) and beryllium copper (1/16 x 3/16 through 1/4 x 3 1/2 in.). See your SPS distributor or write for Bulletin 2670.



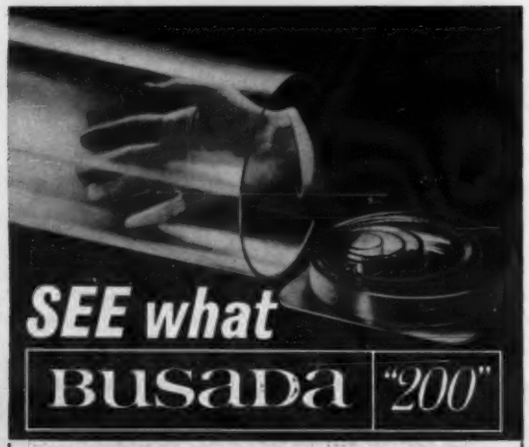
In hinge



INDUSTRIAL FASTENER Division SPS

JENKINTOWN 6, PENNSYLVANIA

Circle 57 on Reader-Service Card for more information



SEE what BUSADA "200"

TRANSPARENT TUBING can do for your product

Extruded Tenite butyrate tubing in an exceptionally wide range of sizes. Smallest is 0.750" O.D. x 1/16" . . . O.D.'s go up to 8 1/2", wall thicknesses to 1/4" . . . 84 standard sizes in all . . . custom sizes available on special order. Crystal clear, tough; highly machinable, highly dielectric, highly usable. Get the full story on this versatile plastics tubing . . . transparent BUSADA "200." Send for descriptive brochure today.

BUSADA MANUFACTURING CORPORATION

Specialists in Transparent Plastics Tubing and Pipe

32-11 Downing St. • Flushing 54, N. Y. • LEnox 9-3431

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DESIGN NEWS — DESIGN IDEAS — MATERIALS

Reduced Weight Increases Galvanometer Natural Frequency

Edward W. Schrader, Western Editor

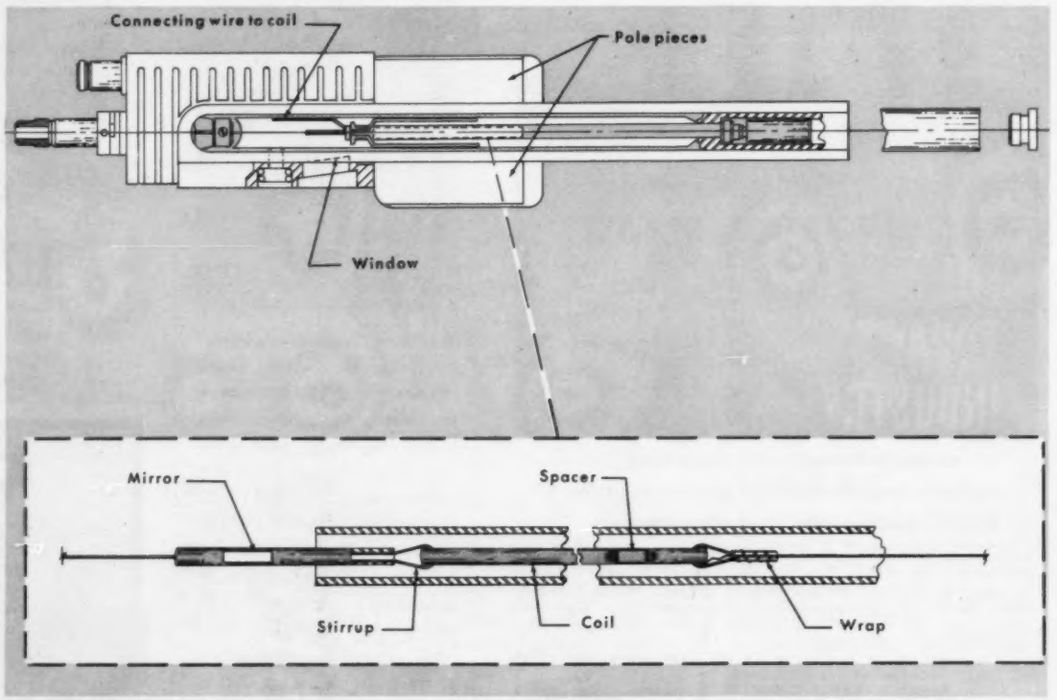
In instrumentation, galvanometers record alternating currents of complex waveforms with many frequency components. For this use, galvanometers must maintain constant sensitivity over a broad frequency band. A nearly flat response will enable a galvanometer to follow accurately the various components of a complex wave.

Galvanometers are normally designed with optimum damping (64 percent of critical) and have a flat frequency response (± 2 percent) of the best line from zero to 60 percent of the natural frequency. Thus, it is desirable that the natural frequency be as high as possible, consistent with sensitivity considerations. To raise the natural frequency, stiffer suspensions and lighter coil masses must be used.

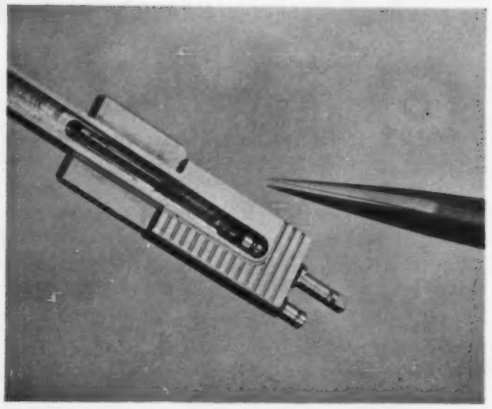
By employing new types of wire, insulations, cements and reduced mass, the miniature d'Arsonval-movement galvanometers have increased natural frequency to 13,000 cps.

The coil is enameled aluminum wire with an air core. The 48 turns of 0.0007-inch-dia wire use jewel spacers cemented in place. Each turn of the coil is insulated and bonded to the previous turn by a potting compound, which, when cured, stiffens the coil bobbin assembly. A wire suspension stirrup or loop is formed around the top of the coil, and its ends are inserted into a stiffener tube, where they are secured by soldering.

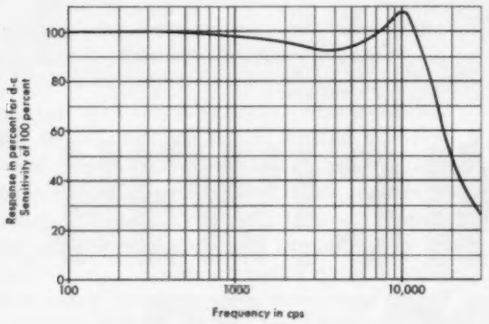
An aluminum mirror of 99.99 percent purity is bonded to the mirror cutout in the stiffener tube, thus achieving maximum stiffness between the re-



ARRANGEMENT OF COMPONENTS in miniature galvanometer. Permanent-magnet pole pieces create magnetic field for coil. Rays of light from source are reflected by galvanometer mirror to photosensitive paper to measure currents at sensitivity of 70 milliamps per inch. Spot deflection varies in direct proportion to changes in driving current through moving coil.



ASSEMBLY OF UNIT takes place under microscope.



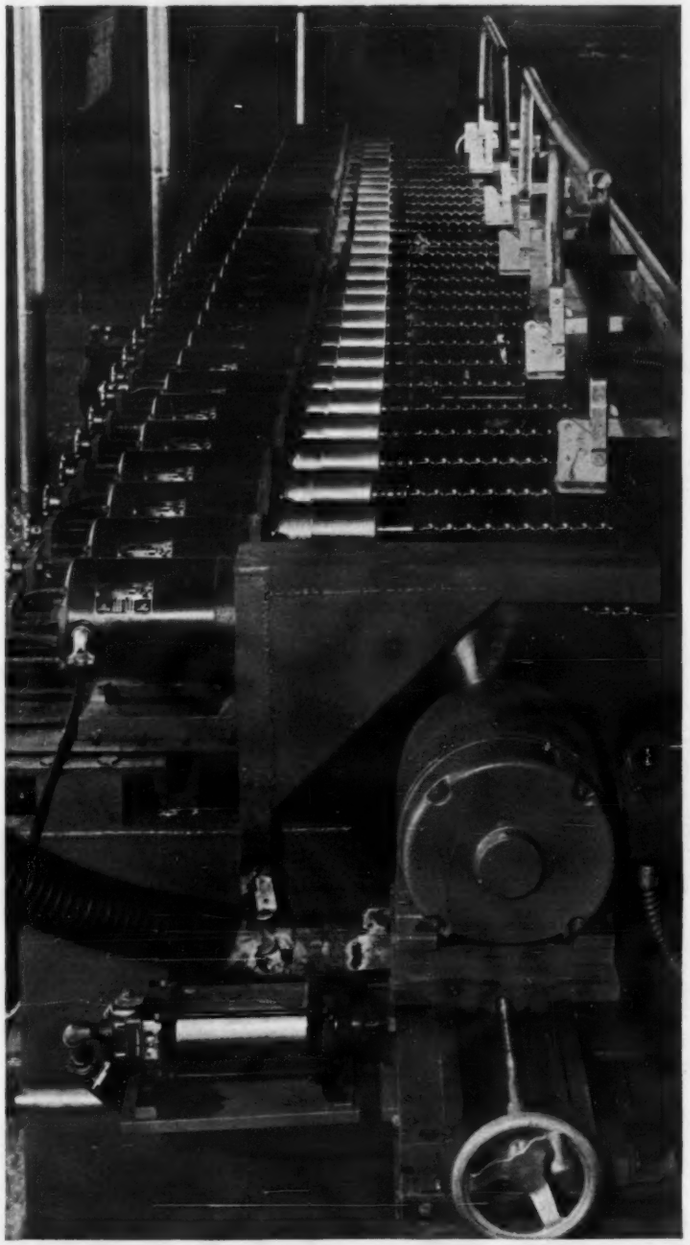
RESPONSE VERSUS FREQUENCY for 1-inch double amplitude deflection. Curve is nominal characteristic of galvanometer with natural frequency of 13,000 cps. Tolerance on unit is ±5 percent of curve from 0 to 13,000 cps. High natural frequency unit does not have identical characteristics of other lower natural frequency units.

flecting surface of the galvanometer and the coil. For the higher natural frequency galvanometer, the aluminum mirror size was reduced from 0.060 inch by 0.020 inch to 0.030 inch by 0.02 inch rectangle.

A bottom suspension wire loops around the bottom of the coil. It is secured by wrapping bare copper wire around the lap joint.

The entire suspension is immersed in fluid to produce the desired damping to retard oscillation of the vibratory system. A glass tube encases the system.

The high-performance galvanometer is a design development of the Transducer Div., Consolidated Electrodynamics Corp., Pasadena, Calif.



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This wood boring machine, manufactured by the Indiana Foundry Machine and Supply Company, is installed in the new Kopper's Company, Inc. Plastics Division plant in Detroit, Michigan.

It's not too often that you see thirty motors lined up like this, providing power for one machine. But, whether the number of motors in a particular application adds up to 3, 30, or 300 . . . if they're Wagner Motors, you know they're really doing a job. That's usual, for Wagner Motors have been getting the job done for more than 65 years. And, a program of constant research and development in electric motor design makes sure that Wagner Motors will continue to lead *where it counts* . . . in performance!

Mind a suggestion? Call your nearby Wagner Sales Engineer for an analysis of your next motor application, be it for plant or product. Whatever your requirements, Wagner can supply a standard motor, or build a special motor to fit your needs. There are Wagner branches in 32 principal cities across the country, at your service.

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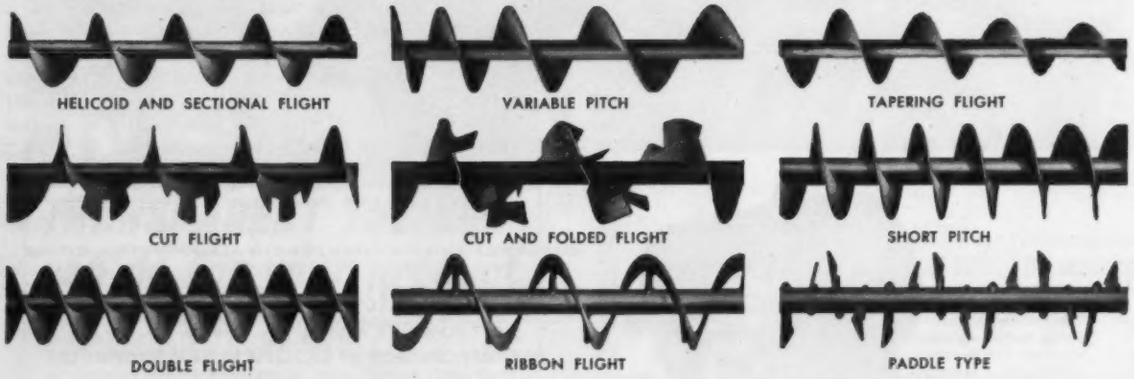

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Polystyrene Insulating Shell

Lars G. Soderholm, Midwest Editor

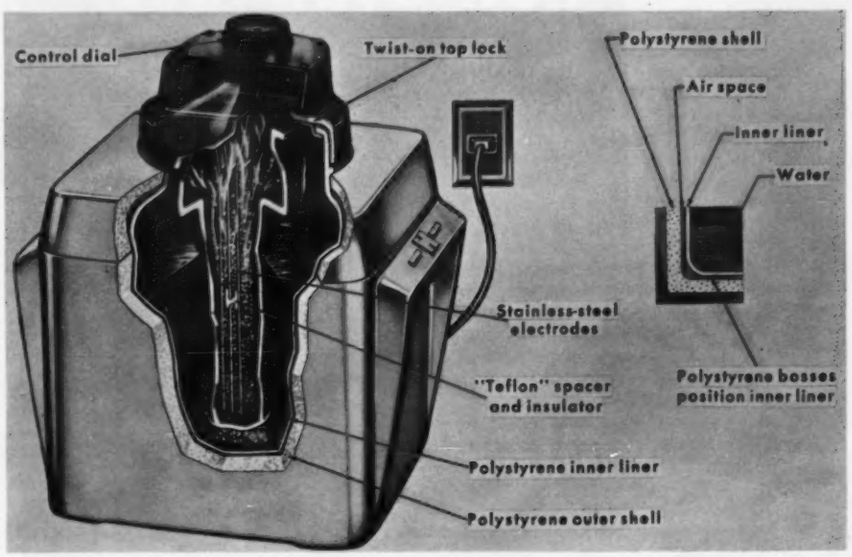
An expanded polystyrene outer shell approximately 1/2 inch thick prevents heat buildup from operation of an electric vaporizer. The outer container is located so as to provide a 1/2- to 1-inch air space between the polystyrene shell and the polyethylene inner container.

Since the boiling of water is a necessary function of an electric vaporizer, the heat buildup has been accepted generally as an associated nuisance. The manufacturer of this new vaporizer, in order to eliminate the possibility of the unit scorching a table or burning a person trying to move the unit, has provided an insulating shell about the water container. Tests have indicated that while the temperature of the inner container can get up to 170 to 180F, the outer surface of the polystyrene insulating shell hardly rises over room temperature.

Additional safety devices on this unit include a twist-type lock-on cap. If the unit should tip over, the water cannot spill out. There is, however, enough steam leakage capability designed into the cap so that if for any reason the regular steam outlet should clog up, there will be no pressure buildup within the unit.

The "Vapormaster" line of electric vaporizers comes in 1/2-gal, 1-gal and 1-gal adjustable sizes. The adjustable unit has three electrodes controlled from a top switch for regulated steam output. These units were made by the Hankscraft Co., Reedsburg, Wis.

Provides Cool Vaporizer Housing



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DESIGN DATA NEWS

Nomograms for the Venturi-Meter Equation

And for Nozzles and Orifices

S. R. Uniechowski, Assoc. Professor,
University of Detroit, Detroit, Mich.

The three nomograms presented permit computation of the discharge in cu ft/sec or gpm through fluid-measuring devices.

The main relation has been obtained by combining the formula generally used

$$Q = C_v A_2 \sqrt{2gh / [1 - (D_2/D_1)^4]}$$

with the manometric equation written for the space between sections of the pipe upstream (1) and the throat of the meter (2), giving:

$$Q = C_v A_2 \sqrt{2gR' [(S_0/S_1) - 1]/[1 - (D_2/D_1)^4]}$$

Where:

- Q = discharge, cu ft/sec
- A_2 = sectional area of the throat, sq ft.
- C_v = velocity coefficient for venturi meters or discharge coefficient C_d for orifices and nozzles
- D_2 = diameter of throat, ft
- D_1 = diameter of pipe, ft
- R' = deflection of differential gage, ft
- S_0 = specific gravity of manometer fluid
- S_1 = specific gravity of fluid flowing

The formula is convenient because the given data from an experiment, namely gage reading and the specific gravities of both fluids, can be substituted directly and, furthermore, is entirely independent of the orientation of the meter.

Nomogram I gives values of D_2/D_1 and S_0/S_1. Nomogram II gives values of $K = C_d / \sqrt{[1 - (D_2/D_1)^4]}$ and $KA_2 = K\pi D_2^2/4$. For nozzles and orifice meters, the value of K is frequently given. In such a case, only the second

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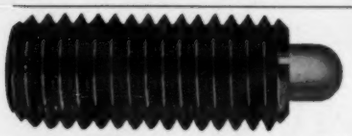

SPRING PLUNGERS are now available in four types and thirty-four sizes. Black Pentrate Nose with standard spring pressures, 6-32 thru 1"-8 threads. Cadmium Plate Nose with light spring pressures, 6-32 thru 1"-8 threads. Black Nylon Nose with standard spring pressures, 8-32 thru 5/8"-11 threads. White Nylon Nose with light spring pressures, 8-32 thru 5/8"-11 threads. Northwestern Tools, Inc., 115 Hollier Ave., Dayton 3, Ohio.

PLASTIC BALL KNOBS with brass inserts are now available in four diameters and twelve thread sizes. 3/4" diameter with 10-32 threads. 1" diameter with 1/4-20, 1/4-28, 5/16-18 or 5/16-24 threads. 1 3/8" diameter with 3/8-16, 3/8-24, 1/2-13 or 1/2-20 threads. 1 7/8" diameter with 1/2-13, 1/2-20 or 5/8-18 threads. Northwestern Tools, Inc. 115 Hollier Ave., Dayton 3, Ohio.

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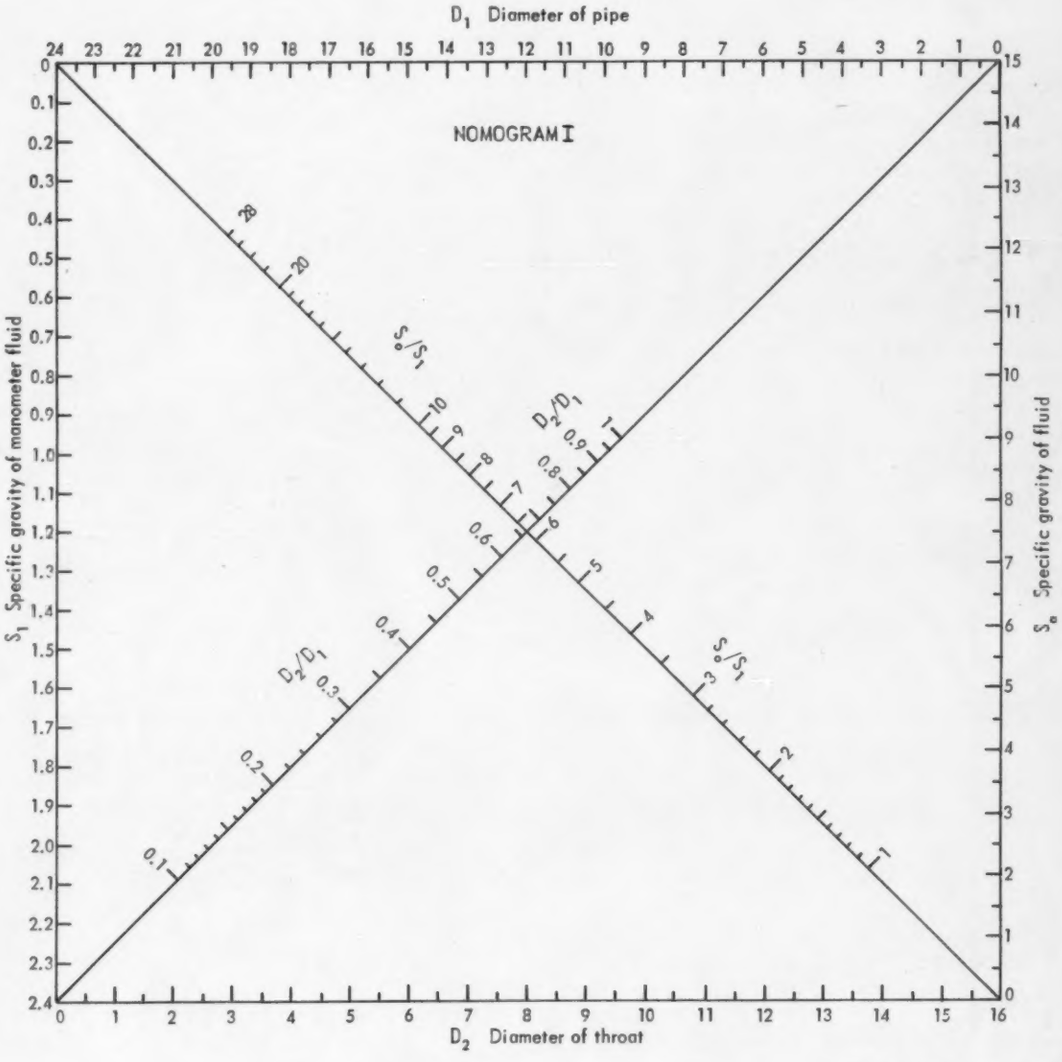
part of the nomogram should be used (i.e., obtaining $KA_2 = K\pi D_2^2/4$ from K and D_2 scales). Nomogram III gives discharge in cu ft/sec or gpm for KA_2 obtained from Nomogram II and given R and S_o/S_1. The left bottom scale on the S_o/S_1 line is for cases when the manometric fluid has a lower specific gravity S_o than the fluid flowing through the meter S_1. In this case, the manometer must be inverted and in the formula the expression inside the square bracket under the radical becomes $[1 - (S_o/S_1)]$.

Example: If $D_1 = 7$ inches, $D_2 = 4$ inches, $S_o = 13.56$ (mercury), $S_1 = 0.9$ (oil), $C_v = 0.9$ and $R = 5$ inches, determine discharge flow in cu ft/sec.

Solution: Using Nomogram I, align $D_1 = 7$ with $D_2 = 4$, intersecting $D_2/D_1 = 0.57$. Align $S_o = 13.56$ with $S_1 = 0.9$, intersecting $S_o/S_1 = 15.1$.

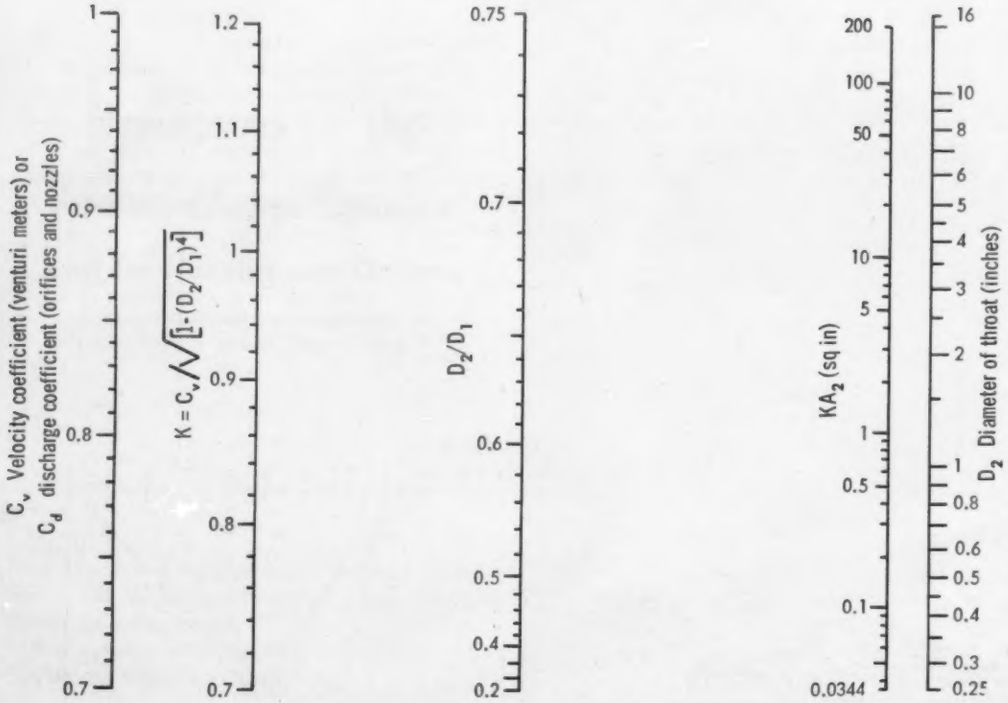
Using Nomogram II, align $C_v = 0.9$ with $D_2/D_1 = 0.57$ (From Nomogram I), intersecting $K = 0.95$. Align this intersection with $D_2 = 4$, intersecting $KA_2 = 12$. Using Nomogram III, align $KA_2 = 12$ (From Nomogram II) with $R = 5$, intersecting the Reference line. Align this intersection with $S_o/S_1 = 15.1$ (From Nomogram I) and read $Q = 1.6$ cu ft/sec.



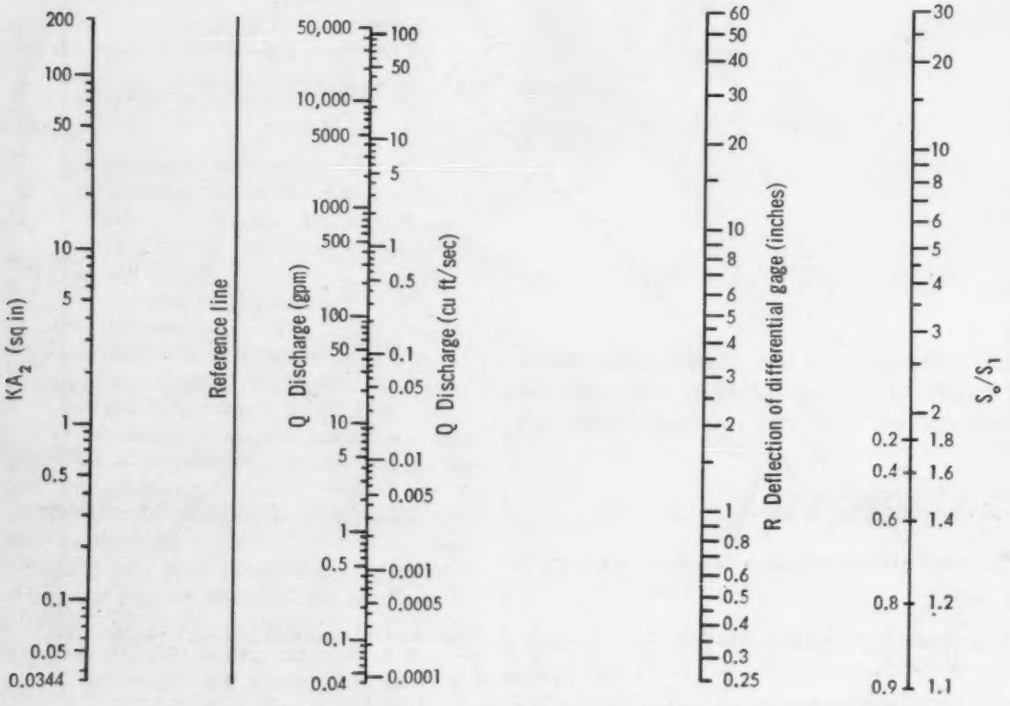
(Continued on next page)

Venturi-Meter Equation . . . Con't.

NOMOGRAM II


C_v Velocity coefficient (venturi meters) or
C_d discharge coefficient (orifices and nozzles)
$K = C_v\sqrt{[1-(D_2/D_1)^4]}$
D_2/D_1
KA_2 (sq in)
D_2 Diameter of throat (inches)

NOMOGRAM III



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Normal Stress—Welds

S. Warren Kaye, Peabody, Mass.

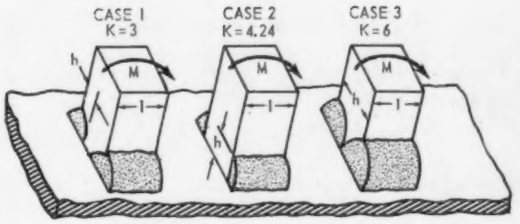
Normal stresses for three weld connections are solved by the nomogram:

$$S = KM/hl^2$$

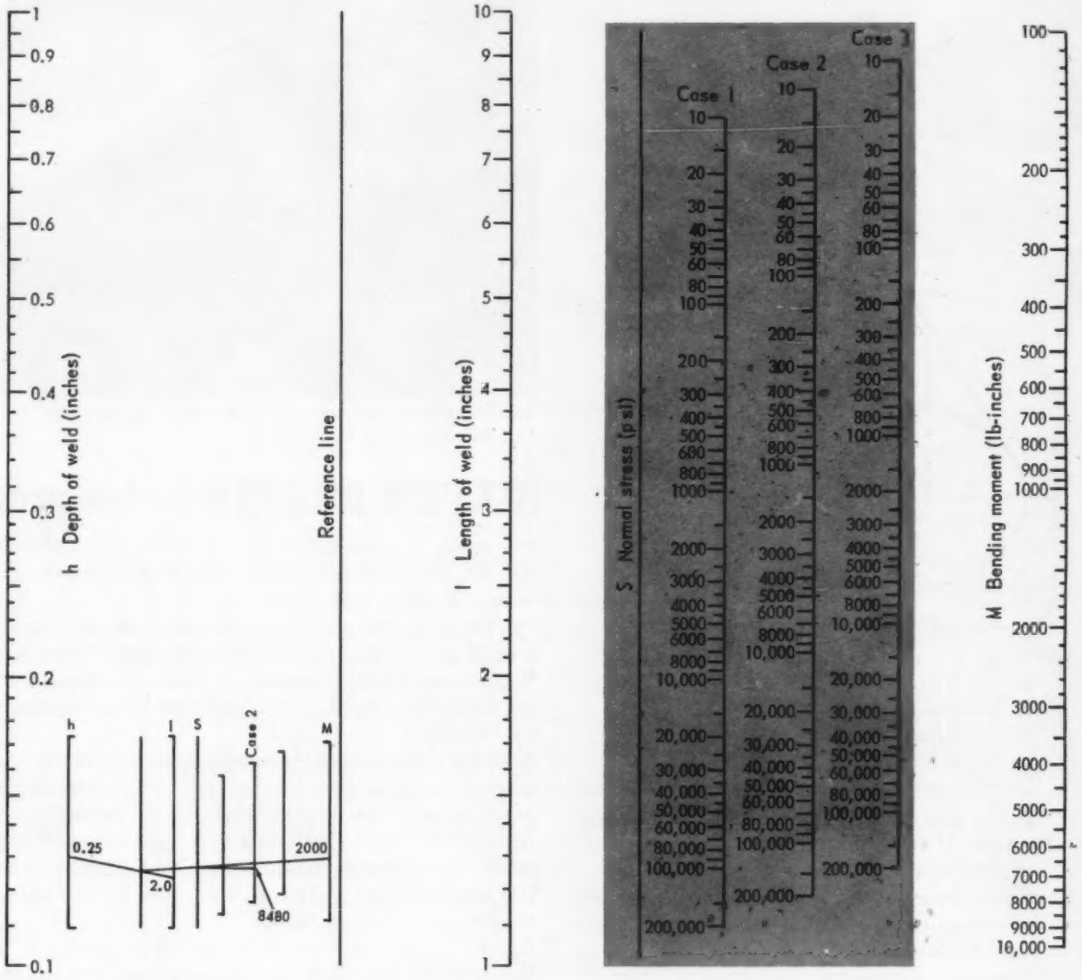
Where:

- S = Normal stress, psi
- M = bending moment, lb-in
- h = depth of weld, inches
- l = length of weld, inches
- K = constant (Case 1, K = 3; Case 2, K = 4.24; Case 3, K = 6)

Example: If a beam is welded with a fillet weld (Case 2), and M = 2000 lb-in, h = 0.25 inch and l = 2.0 inches, determine normal stress.



Solution: Align h = 0.25 with l = 2.0, intersecting Reference line. Align this intersection with M = 2000, intersecting S line. Project horizontally to Case 2 and read S = 8480 psi.



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Average Volume of a Cylinder Inscribed in a Right Circular Cone

Nicholas S. Hodska, Stratford, Conn.

The mean volume of the body in question about an axis is:

$$V_m(y) = [1/(H-0)]\int_0^H V\,dy \quad (1)$$

From Fig. 1, by similar triangles

$x/R = (H-y)/H$ or $x = (R/H)(H-y)$

Hence:

$$V = \pi x^2 y$$
$$= (\pi R^2/H^2)(H-y)^2 y$$
$$= (\pi R^2/H^2)(H^2 y - 2Hy^2 + y^3)$$

Replacing these values in Equation (1):

$$V_m(y) = (1/H)\int_0^H (\pi R^2/H^2)(H^2 y - 2Hy^2 + y^3)\,dy$$

$$= (\pi R^2/H^3)\left[\frac{H^2y^2}{2} - \frac{2Hy^3}{3} + \frac{y^4}{4}\right]_0^H$$

$$= \pi R^2 H/12 \quad (2)$$

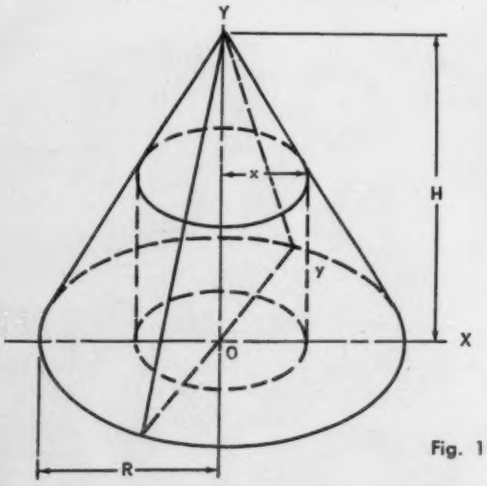


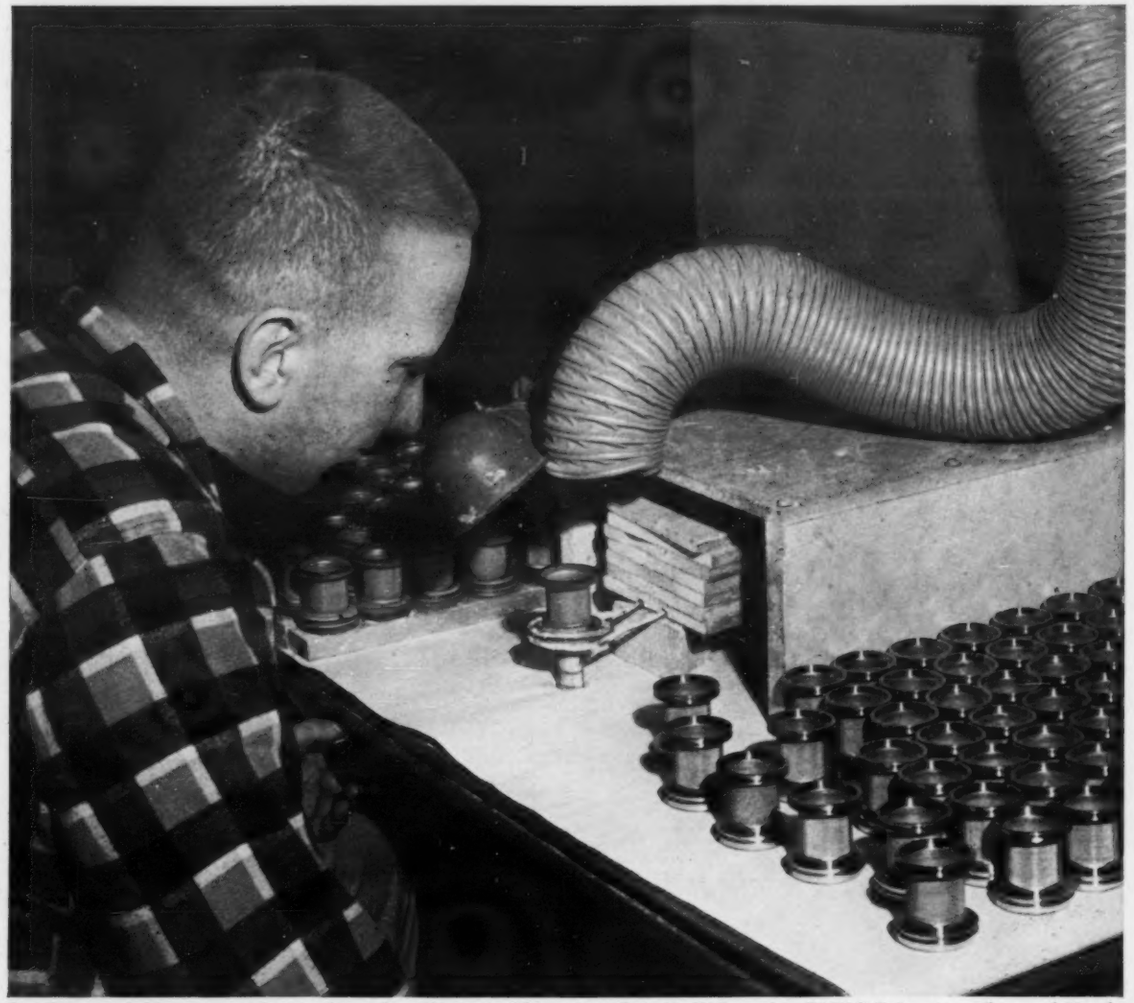
Fig. 1

Where:

- R = radius of the base of the cone, inches
- H = altitude of the cone, inches
- V = volume of the inscribed cylinder, cu in
- V_m = mean volume, cu in
- x = radius of the inscribed cylinder, inches
- y = altitude of the inscribed cylinder, inches

Example: If H = 18.0 inches and R = 3.0 inches, determine V_m.

Solution: Project horizontally from H = 18, intersecting the Reference line. Project downward from this intersection to R = 3, thence horizontally to read V_m = 42 cu in.



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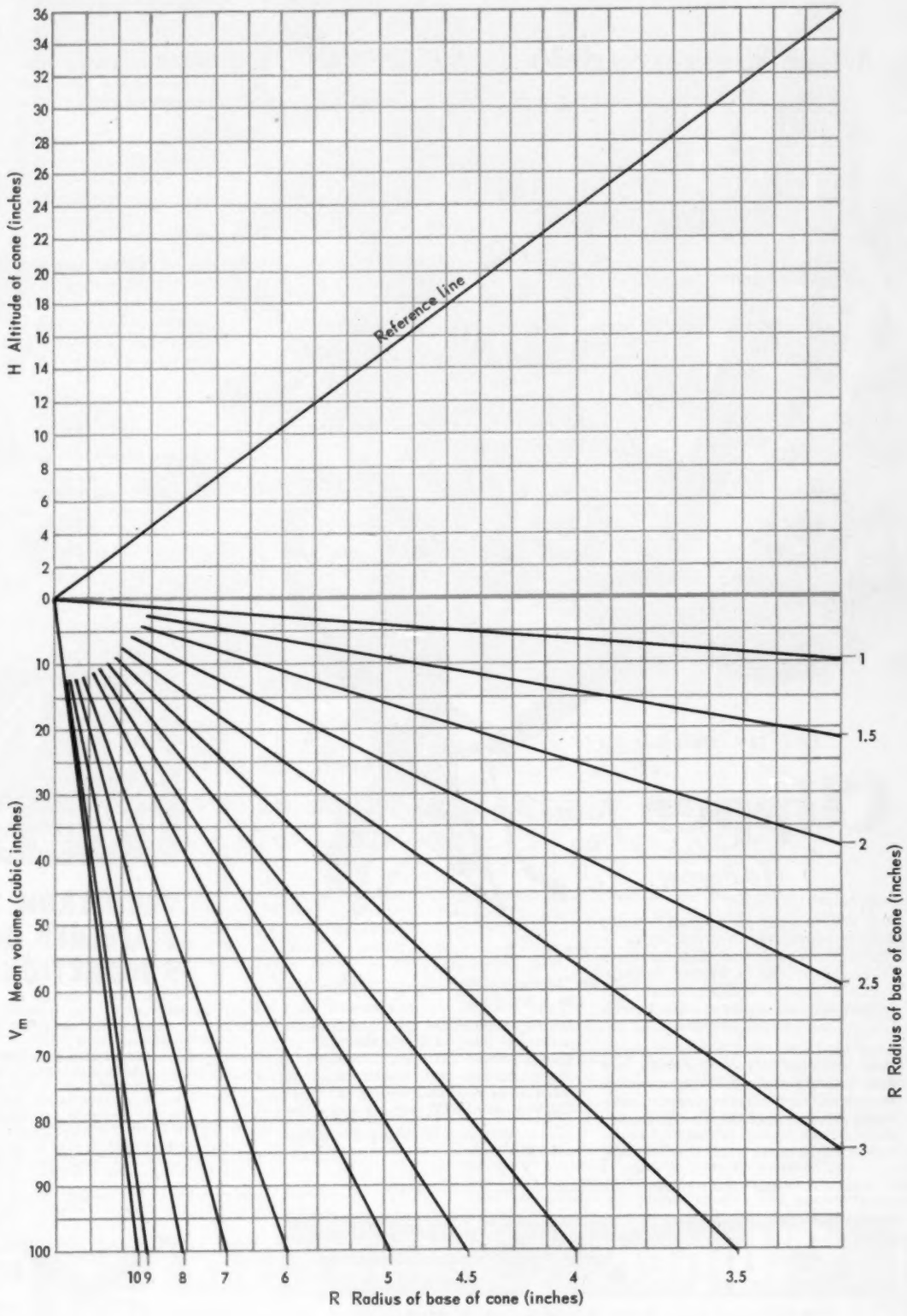

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NEW LITERATURE

To obtain copies of numbered literature . . . circle appropriate number on Reader-Service card.

Gear Size Nomogram 451

A revolving gear with teeth passing near an electromagnetic pickup is sometimes used to determine shaft speed or to generate electric signals. This nomogram, printed on plastic-coated medium-weight stock, allows calculation of gear sizes needed for required voltage or frequency to be generated by the pickup, the calculation of gear surface speeds from rpm or expected voltages, and/or frequencies generated at various gear speeds. Electro Products Labs., Inc., 4500 N. Ravenswood Ave., Chicago 40, Ill.

High-Temperature Ceramics 452

Detailed information on space-age ceramic compositions, including alumina, magnesia, thoria and zirconia, are found in this 32-page catalog. Sizes and prices for crucibles and tubing available from stock and data on custom ceramic items are provided. The manufacturer's "Leco-Kote" flame spray tubing is illustrated and specifications are given. An application questionnaire completes the brochure. Laboratory Equipment Corp., St. Joseph, Mich.

Optical Terminology Glossary 453

The first in a continuing series of terminology glossaries, this one-page sheet covers a wide range of technical terms from "aberrations" to "surface reflections". The glossary, and additional ones to follow, is specifically designed for use as a reference work by engineering and other industrial personnel, and by educational institutions as a teaching aid. Servo Corp. of America, 111 New South Rd., Hicksville, L.I., N.Y.

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Automobile Fuel Measurement System **454**

A four-page folder describes the Mark 1 "Drive Master" system for checking car engine performance and for obtaining fuel economy. The unit is claimed to provide 20 to 25 percent better gas economy and to serve as a warning signal of trouble developing in an engine. What it is—how it works—savings in fuel—trouble-warning system and system specifications are included in the literature. Ongaro Dynamic Industries, 1035 Third Ave., Columbus 12, Ohio.

Brazing Alloys Comparison Chart **455**

This two-page chart compares "Ambraze" alloys with 14 other tradename alloys. All important silver, copper and brass-base alloys are detailed and AWS-ASTM designations are given for all alloys charted. Some of the alloys listed for "Ambraze" are copper, silic bronze, phosphor bronze, naval bronze, nickel bronze, low-fuming bronze, nickel silver, aluminum bronze, "Phos Sil O" and "Phos Sil 15." American Brazing Alloys Corp., Box 11, Pelham, N.Y.

Master Power Supplies **456**

This "Master Power Supply Chart" contains specifications on all laboratory d-c power supplies and a-c line regulators produced by the manufacturer. The notebook-sized, fold-out chart is three-ring punched and lists complete information on output, regulation ripple, impedance, dimensions and price. Included are TVCR, MTR, MAG-AMP regulated, MRST and semiregulated series, plug a-c line voltage regulators. Perkin Electronics Corp., 345 Kansas St., El Segundo, Calif.

Textile Fiber Comparison Chart **457**

This two-page fold-out chart shows resistances of all generic fibers to acids, alkalies, salts, solvents and oxidizing agents. Concentration and temperature of the reagents are indicated and the extent to which the fibers and/or reagents resist chemical change. The chart also defines the generic, man-made fibers and specifies the various trade names. The folder is designed to assist in specific problems of textile application and fabrication. Filtration Fabrics Div., American Machine & Metals, Inc., East Moline, Ill.

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THIS CATALOG IS YOURS *on request. It gives dimensional data and engineering "specs" on the Type 16 and the whole broad Licon line. Send for yours today.*

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Licon Type 16 subminiature switches are presently in use in missile detonators, sensing devices on automatic machine tools, automatic postal equipment, speed control devices, communication equipment, coin changer equipment, automatic door openers, relay actuation, and a host of airborne controls, including hermetic and environment-free units.

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LITERATURE

Laboratory Supplies and Instruments **458**

This 936-page catalog illustrates thousands of laboratory supplies and instruments. Each item is described and up-to-date information is given on the latest laboratory instruments. Specifications given are complete enough to enable purchasing directly from the catalog. The hard-cover catalog lists units alphabetically and a cross-referenced subject index provides fast location of any item. LaPine Scientific Co., 6001 S. Knox Ave., Chicago 29, Ill.

Aircraft Cockpit Voice Recorder **459**

The latest in a series of special-purpose recorders is illustrated and described in a four-page folder. The unit is claimed to meet all requirements of recent FAA Project 307-11 specification for a transport aircraft voice recorder and is available in a variety of configurations. The basic recorder and its operation are outlined, and operating and physical characteristics for all models are tabled. Special Devices Div., Lockheed Aircraft Service, Inc., Ontario International Airport, Ontario, Calif.

Mechanical and Electrical Instrument Counters **460**

Catalog 400, 16 pages, provides a reference for engineers for digital readout indicators in navigation and gaging instruments, radar control computers, business machines, missile-tracking devices and position indicators. The brochure provides complete data on both mechanical and electrical instrument counters and with the information presented, hundreds of variations of counting instruments may be determined. A complete line of counters is illustrated and specifications are provided for each series. Durant Mfg. Co., 1929 N. Buffum St., Milwaukee 1, Wis.

Plumbing, Heating and Air-Conditioning Supplies **461**

This 160-page catalog covers heating, plumbing and air-conditioning supplies; a line of plumbing fixtures, plumber's brass, lighting fixtures and electrical supplies; construction tools, hardware and power tools; custodial and maintenance equipment. Catalog 21 offers a complete centralized buying service and an alphabetical index to all parts and units included. A technical and engineering data section provides the following tables: "Heat Emission from Horizontal Bare Iron or Steel Pipes in Air at 70F", "Water Heating Loads versus Temperature Rise for Various Gallon-Per-Hour Rates", "Square Inch Area Required for CFM Against Velocity", plus combustion efficiency charts and conversion-factor tables. A. R. Webber Co., Inc., 142 Orange Ave., West Haven, Conn.

Designers think of R/M first for asbestos, rubber,

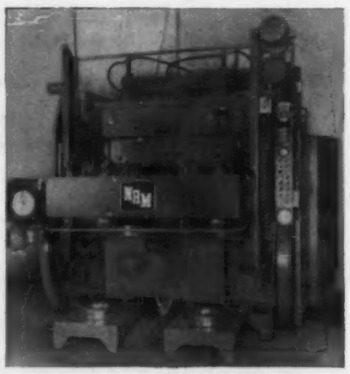
Solves major operating problems for tire press manufacturer with new Teflon*-impregnated molded asbestos piston cups

New molded asbestos piston cups impregnated with Teflon, developed by Raybestos-Manhattan, Inc., have enabled National Rubber Machinery Company, Akron, Ohio, to improve the economy and efficiency of its Autoform Slideback Tire Press while realizing substantial savings. The new seal has not only reduced air loss to a minimum, but eliminated a lubrication system, cut maintenance, and increased machine operating life.

Before adopting R/M cups, NRM used metal rings for the ram and cylinder assembly. These did not provide the seal required, permitted a 5 to 10% air loss, caused excessive wear on moving parts, and required lubricants which were entrained, seeped into the molds, and damaged the tire rubber.

In considering a suitable replacement for the metal rings, NRM tested various synthetic rubber and leather cups. All deteriorated rapidly in temperatures up to 380°F. Then R/M was consulted. Preliminary investigation indicated asbestos with a Teflon filler as a potentially good combination for this application. Nearly a year of research, testing and engineering collaboration followed. Samples were developed and tested in the field under actual operating conditions. Only when all results were in—after two years—did NRM adopt R/M cups for use in all its presses.

R/M's experience in the manufacture of packings, gasket materials, and specialty products to meet the exacting and varied requirements of industry is at your disposal—whatever your need call on R/M.



The application of R/M piston cups provided two important benefits. It eliminated oil in the curing room, preventing damage to the tire rubber. It reduced air loss with properly fitted and installed cups.

Registered trademark for Du Pont fluorocarbon resins

PACKINGS

For complete information on R/M Molded Piston Cups and other R/M packings and gasket materials, write for new Catalog P-100. Packing Division, Raybestos-Manhattan, Inc., Passaic, N.J.

Circle 72 for more information on Packings

sintered metal, and engineered plastic products

Non-burst Rubber Steam Hose

Strength of steel, heat resistance of asbestos, flexibility of rubber

For saturated steam pressures to 200 lbs., 388°F. Strength and durability are employed throughout the construction of Super-Master BW Steam Hose, illustrated above. Braids of high-tensile, non-corrosive steel wire are applied at a controlled angle over an asbestos-covered steam-resistant rubber tube for greatest strength with minimum elongation and contraction, and provide positive protection against bursting. Special Butyl rubber cover resists heat and weather, has static dissipating wire. The safest high-pressure steam hose made. Write for Bulletin M630.

Rubber hose for every purpose—air, oil, suction, Teflon hose for corrosive chemicals, flexible rubber pipe and expansion joints for abrasion and vibration... outlasts steel pipe. Write for Catalog M5.

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Write today for free booklet shown: full details on a wide variety of industrial rubber products. Manhattan Rubber Division, Raybestos-Manhattan, Inc., Passaic, N. J.

BOND FAILURES CAN BE PREVENTED!

Here's how to stop 13 of them . . .

Type of Failure	Solution
THERMOSETTING ADHESIVES	
• Cohesive failure	Check film with solvent used in adhesive. If solvent softens the adhesive film or becomes tacky, this indicates insufficient cure. Make sure bond line time and temperature is used.
• Adhesive failure from metal	If metal surface has a white, clean appearance, check cleaning technique.
• Adhesive failure from substrate other than metal	Try prime coat of diluted adhesive, also check compatibility.
• Cellular areas in adhesive line	Increase pressure and/or adhesive.
CONTACT ADHESIVES —room temperature setting	
• Tacky film	If film should dry hard but remains tacky, the cause may be entrapped solvent or migration of plasticizer from one substrate.
• Shiny areas	Poor contact, insufficient pressure or insufficient amount of cement.
• No bond	If heat reactivated type, adhesive was too cool at time of assembly or poor compatibility.
• Failure in adhesive from metal	Improper cleaning.
• From substrate other than metal	Incompatible or unclean surfaces.
HOT MELT	
• No bond	Incompatibility, adhesive too cool at time of assembly. Parts too cool at time of application of adhesive.
EPOXY BASE ADHESIVES AND CASTING COMPOUNDS	
• High exotherm	Mix lower volume and pour mixed material into shallow tray. Cool base and activator before mixing or use Metermixing equipment.
• Tacky film or casting	Improper base activator ratio, improper mixing of base and activator, improper cure. Check bond line temperature.
• Flexible casting or film of rigid adhesive or casting compound	Improper mixing of base and activator, improper base and activator, improper cure. Check bond line temperature.

Bond failures can be prevented! Raybestos-Manhattan's adhesive experts also have solutions to less common causes of bond failures . . . based on more than 20 years' experience in the production of bonded assemblies and the manufacture of adhesives, coatings and sealers. Why not call on them today for the answers to your adhesive problems—no cost or obligation, naturally.

ADHESIVES

Get helpful engineering information on selecting, bonding and testing adhesives. Write today for your free copy of Bulletin No. 701. Adhesives Department, Raybestos-Manhattan, Inc., Bridgeport, Conn.

RAYBESTOS-MANHATTAN, INC.

FACTORIES: Passaic, N.J. • Bridgeport, Conn. • Manheim, Pa. • Paramount, Calif. • No. Charleston, S.C.
Crawfordsville, Ind. • Neenah, Wis. • Peterborough, Ontario, Canada

Circle 73 for more information on Rubber

Circle 74 for more information on Adhesives

LITERATURE

How to Make Maps **462**

Provides a color-illustrated course on modern map production. Graphic diagrams explain the fundamentals used in producing color-separated maps. Step-by-step procedures show how "Stabilene" films can be used to save time and money in the preparation of multicolor topographical maps from negative compilation, and multicolor aeronautical maps from positive compilation. The 12-page brochure also includes production of single-color highway construction maps. A glossary of mapping terms completes the folder. Keuffel & Esser Co., Third and Adams Sts., Hoboken, N.J.

Industrial Gas Data **463**

A 48-page, pocket-sized book lists physical and chemical properties of acetylene, argon, carbon dioxide, helium, hydrogen, krypton, neon, nitrogen, oxygen and xenon. In addition, the leatherette-bound Form ADE-890 gives properties of the medical gases—cyclopropane, ethylene and nitrous oxide. Tables provide quick conversion of volumetric information on industrial gases from one equivalent unit of measure to another. Charts and diagrams provide data on industrial gas delivery and storage systems. Air Reduction Sales Co., Div. of Air Reduction Co., Inc., 150 E. 42nd St., New York 17, N.Y.

Cylindrical Accumulators **464**

Details a complete line of floating-piston cylindrical accumulators. The 80-page catalog presents cutaway views of both single and double-shell accumulators ranging in oil volume from 7.07 cu in up to 43.7 gal maximum, with maximum working pressures from 2000 to 5000 psi. Dimensions, specifications and volume-pressure charts are given for accumulators designed for operating temperatures from −40 to 180F, handling commercial hydraulic fluid. Auxiliary gas bottles and accumulator charging and gaging assemblies also are included. Superior Hydraulics Div., Superior Pipe Specialties Co., Box 3844, Cleveland 10, Ohio.

Electrical Wiring Devices **465**

A 96-page catalog illustrates and describes more than 1500 electrical wiring devices, lamps and specialty products. Useful as a reference for contractors, consulting engineers and architects, products are grouped in categories and are cross-indexed for quick location. New items added to this catalog include "Touch-A-Matic" quiet switches and quiet a-c switches with toggle handles. A few of the items included are specification-grade electrical wiring devices, switches and receptacles, transformers, wall plates and pushbuttons. Eagle Electric Mfg. Co., Inc., 23-10 Bridge Plaza S., Long Island City 1, N.Y.

Here's why leading manufacturers specify*

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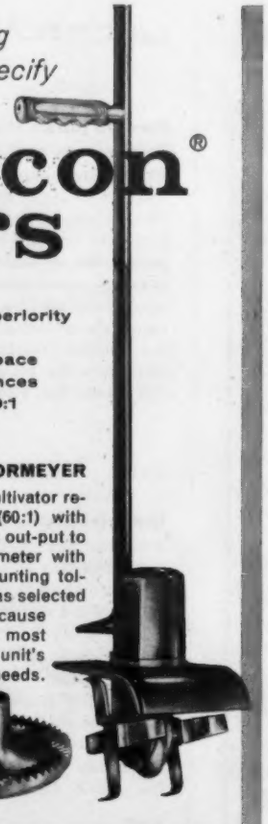

✻ ON-THE-JOB PROOF AT DORMEYER

The Dormeyer CU-1 lawn cultivator required a high gear ratio (60:1) with single reduction, right angle out-put to in-put, and small gear diameter with high loading, maximum mounting tolerances. Helicon gearing was selected for the cultivator drive because Dormeyer found its features most adequately satisfied all of the unit's requirements and design needs.

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Specially hardened and heat treated Helicon gears are used in the engine transmission of the Pincor Twenty One front throw trimmer power mower manufactured by the Pioneer Gen-E-Motor Corporation. Helicon gears were chosen because they provide the desired reduction, have excellent loading characteristics for their size, offer simple alignment, are noiseless and give longer service.

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TECHNICAL PAPERS

Shaft Design for Finite Life

P. E. Burke,
Roy C. Ingersoll Research Center, Borg-Warner Corp.

Nomenclature

S/N Curve—A plot of allowable nominal stress of a particular section versus the number of stress cycles to failure.

Theoretical (geometric) stress concentration factor, K_t—

$$K_t = \frac{\text{Maximum stress of the section}}{\text{Average stress of the section}}$$

K_t is obtained analytically based on elastic theory or experimentally by such methods as photoelasticity and strain measurements.

Fatigue stress concentration factor, K_f—

$$K_f = \frac{\text{Endurance limit without stress raiser}}{\text{Endurance limit with stress raiser}}$$

The fatigue stress concentration factor is considered maximum at 1,000,000 cycles and diminishes to 1.0 at 1000 cycles.

The formula for nominal torsional shear stress of a solid round shaft is:

$$S_s = \frac{16T}{\pi D_o^3}$$

where:

S_s = Shear stress, psi
T = Torque, lb-in
D_o = Outside diameter, inches

The formula for nominal torsional shear stress of a hollow round shaft is:

$$S_s = \frac{16T}{\pi} \quad \frac{D_o}{D_o^4 - D_i^4}$$

where:

S_s = Shear stress, psi
T = Torque, lb-in
D_o = Outside diameter, inches
D_i = Inside diameter, inches

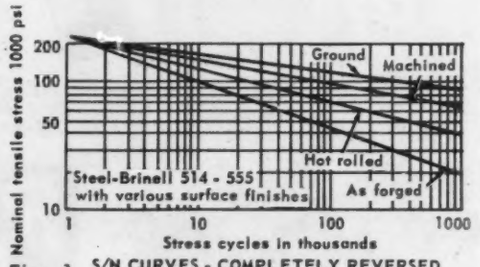
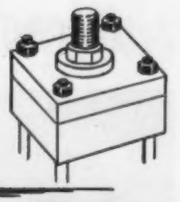
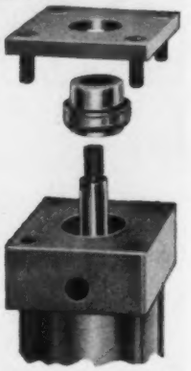


Fig. 1 S/N CURVES - COMPLETELY REVERSED TENSILE STRESS

Why This?



When This Can Be Yours!



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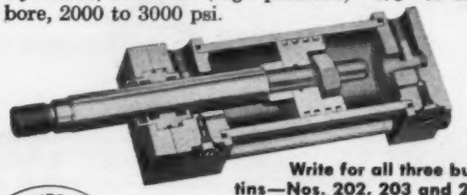
Mo-Bar's *exclusive* feature of using four (4) Allen Head cap screws in place of conventional protruding hex nuts . . . permits easy, quick replacement of the entire cylinder Rod Cartridge assembly . . . with cylinder barrel and tie-rods always permanently in place.

This Mo-Bar "first" gives greater design flexibility . . . particularly for cylinder mounting in tight places.

Other Mo-Bar "firsts" include (1) improved Rod Cartridge design where the long bronze rod bushing is *piloted* into cylinder head—not threaded—for maximum piston rod support . . . and (2) oil-heat resistant, self-adjusting Seal Guard wiper rings, with long conical taper, to throw off all harmful matter from piston rods.

The unique Mo-Bar compact design for air and hydraulic cylinders assures superior performance and unfailing dependability with positive, uniform actuation at all times.

There are Mo-Bar Air Cylinders, series 'a'—1½" to 14" bore, to 200 psi . . . Mo-Bar Hydraulic Cylinders, series 'm' (medium pressure)—1½" to 14" bore, 500 to 2000 psi . . . Mo-Bar Hydraulic Cylinders, series 'h' (high pressure)—1½" to 12" bore, 2000 to 3000 psi.



Write for all three bulletins—Nos. 202, 203 and 204—describing Mo-Bar Air and Hydraulic Cylinders for fluid power applications . . . Dept. A

MO-BAR
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Crystal Lake, Illinois

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THE WAY TO CUT EXCESSIVE WEAR

LISLE *Magnetic* PLUGS

Iron and steel particles that wear off moving parts and circulate in the lubricant are a primary cause of wear to bearings, bushings, gears, cams, etc.

The powerful magnet in the Lisle Magnetic Plug pulls these particles out of the lubricant — assuring longer, quieter, trouble-free, operation of your product.

Lisle Magnetic Plugs can be used in place of any ordinary drain or fill plug.

FREE *Samples for Testing in Your Product!*

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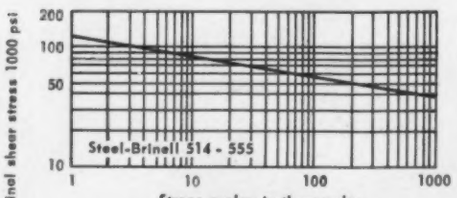

Fig. 2 S/N CURVE - COMPLETELY REVERSED SHEAR STRESS

Design Procedure

Plot nominal torsional shear stresses versus cycles to failure curve as follows:

1. Plot S/N curve for completely reversed tensile stresses. These curves are usually available and are constructed as follows:

a. Given the ultimate tensile strength and the endurance limit for completely reversed loading: (1) the allowable tensile stress at 1000 cycles is approximately equal to the yield strength (Fig. 1), and (2) the allowable tensile stress at 1,000,000 cycles is approximately equal to the endurance limit of the steel (Fig. 2).

2. Plot S/N curve for completely reversed shear stresses. Shear stress is approximately equal to 0.58 tensile stresses. (Constant energy of deformation theory.)

a. Allowable shear stresses for completely reversed loading are obtained as follows: (1) allowable shear stress $\approx$ 0.58 $\times$ tensile stress; (2) allowable shear stress at 1000 cycles $\approx$ allowable tensile stress at 1000 cycles $\times$ 0.58 (Fig. 2), and (3) allowable shear stress at 1,000,000 cycles $\approx$ allowable tensile stress at 1,000,000 cycles $\times$ 0.58 (Fig. 2).

3. Should the part be subjected to other than completely reversed shear stresses such as zero to plus or a plus to plus, the modified Goodman diagram is used to convert the completely reversed shear stresses to those desired.

a. Converting from completely reversed allowable shear stress to zero to maximum allowable shear stress for 1000 and 1,000,000 cycles is shown in the modified Goodman diagram in Fig. 3.

4. The S/N curve (nominal torsional shear stresses versus stress cycles) for the desired loading can be plotted (Figs. 4 and 5).

a. The allowable nominal shear stress curves or S/N curves become approximately straight lines when using log-log coordinates and plotting stress against stress cycles.

5. The S/N diagram then is modified further by reducing the shear stress diagram at 1,000,000 cycles by the stress concentration factor. In effect, the stress concentration factor merely changes the slope of the S/N curve.

a. Fatigue stress concentration factors are applied by dividing the allowable shear stress at 1,000,000 cycles by fatigue stress concentration

(Continued on next page)

bearings and parts

Take the simple, sure, direct route to lower manufacturing and maintenance cost. Design into your product Bunting Standard Stock Bearings. You avoid inventory investment, delays, confusions, production problems by the immediate availability in small or large lots, from local distributors all over America, of hundreds of different stock sizes of completely finished cast bronze and sintered bronze bearings and bars, aluminum bars and Nylon shapes.

Special design bearings not obtainable from stock can be procured immediately at low cost from Bunting fully equipped machine shops in five industrial centers. The wide range of sizes of Bunting Stock Cast Bronze and Sintered Bronze Bearings makes the alteration of a stock item to a special bearing easy and economical. Bunting Cast Bronze, Sintered Bronze, Aluminum Bars and Nylon shapes provide the materials for special requirements which cannot be made from stock bearings. Your local Bunting Distributor can arrange for such work.

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See Bunting's complete catalog, Sweets Product Design File 11C/BU or ask for Bunting's General Catalog, Form 158; Nylon Catalog, Form 32; Technical Handbook on Bunting Nylon, Form 33; The Technology of Bunting Aluminum, Form 46; Engineering Handbook of Powder Metallurgy, Form 1; Bunting Machine Shop Service, Form 4.

The BUNTING Brass and Bronze Company
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BRANCHES IN PRINCIPAL CITIES

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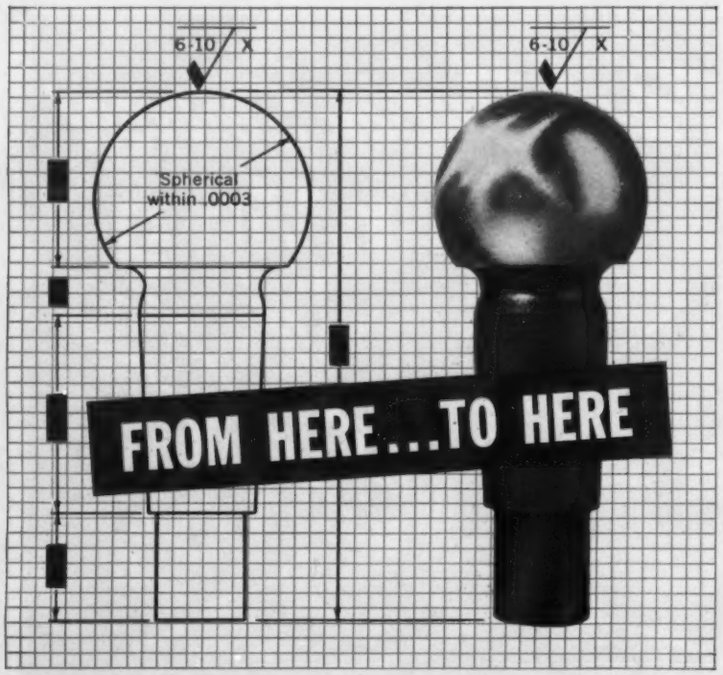

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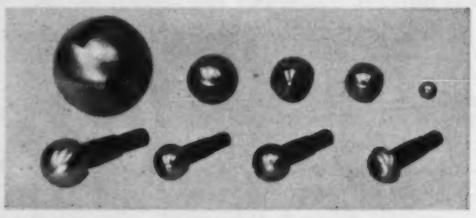
Step 1, cast, forge or cold-head the part; step 2, mill the sphere; step 3, Microhone the sphere. Steps 2 and 3 combine new, specially developed milling and Microhoning, machines which generate sphericity within .0003" tolerance and a controlled microinch finish of 6-10 rms. (Former methods were hard pressed to productively obtain sphericity within .002").

This new method can be applied to any truncated sphere which has a shank or bore to permit holding without touching the sphere. Micromatic will be happy to demonstrate how you, too, can tighten up design tolerances on spheres and also enjoy dramatic production savings. Just call or drop us a line.

Shown here are some typical truncated spheres currently being processed by the Micromatic Method.



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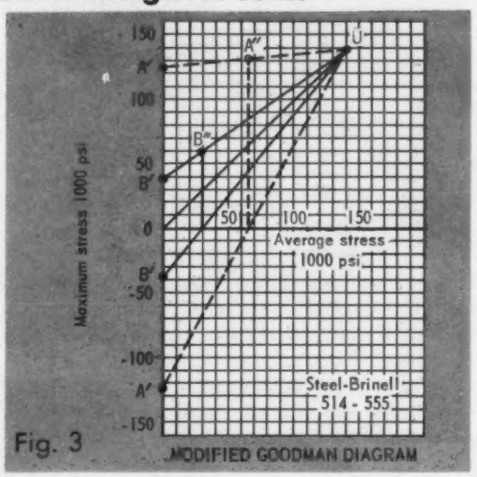

factor and connecting this point with the allowable stress at 1000 cycles ($K_f = 1.00$) with a straight line. This new curve is the allowable nominal shear stress for the particular section of the shaft with a stress raiser. Refer to the S/N diagrams in Figs. 4 and 5.

Predict the design loads and design life as follows:

1. Design loads for transmissions are obtained from engine and converter curves.

2. Design life is based on number of service miles required.

3. Assume, unless there is service life data available: the number of maximum torque cycles per miles; the number of full throttle starts per mile which will probably not exceed 80 percent of full stall torque; the number of cycles at full engine torque (minus converter). It is apparent that the main criterion in the design of shafts for finite life is predicting the number and magnitude of the stress cycles. An example may be as follows:

In a passenger car automatic transmission designed for 100,000 miles of operation, the following assumptions are made:

a. One maximum torque application per 100 miles of operation equals 1000 cycles at maximum torque.

b. One full throttle start, 80 percent maximum torque, per two miles of operation equals 50,000 cycles.

c. Full engine torque applied 10 times per miles of operation equals 1,000,000 cycles at full engine torque.

4. From the design life requirements of "3", the S/N torsional shear stress diagram will indicate the allowable nominal torsional shear design stress. A section having a stress concentration factor may be critical at a different number of stress cycles than one without a stress concentration factor.

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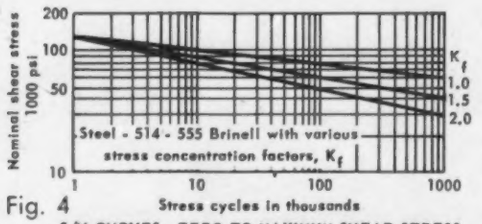


Fig. 4 S/N CURVES - ZERO TO MAXIMUM SHEAR STRESS

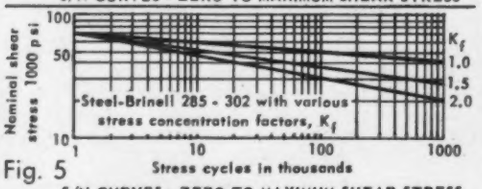


Fig. 5 S/N CURVES - ZERO TO MAXIMUM SHEAR STRESS

The maximum nominal torsional shear design stresses currently used by various manufacturers of passenger car automatic transmissions at maximum converter torque are shown in Table 1. It is evident that shafts for present passenger car automatic transmissions are being designed for finite life. Apparently, these design values are satisfactory because relatively few shaft failures have been experienced.

It is not the intent of this paper to propose designing shafts to the critical limit, unless necessary, but merely to give the designer a clearer impression of the problem he is facing. Using the method outlined in this paper will help the designer evaluate such items as hardness and stress concentration factors somewhat better and will tend to minimize failures in the first prototype designs.

The trend toward compactness will eventually force shaft design toward a more reduced finite life, thereby placing more emphasis on predicting the number and magnitude of the stress cycles more accurately.

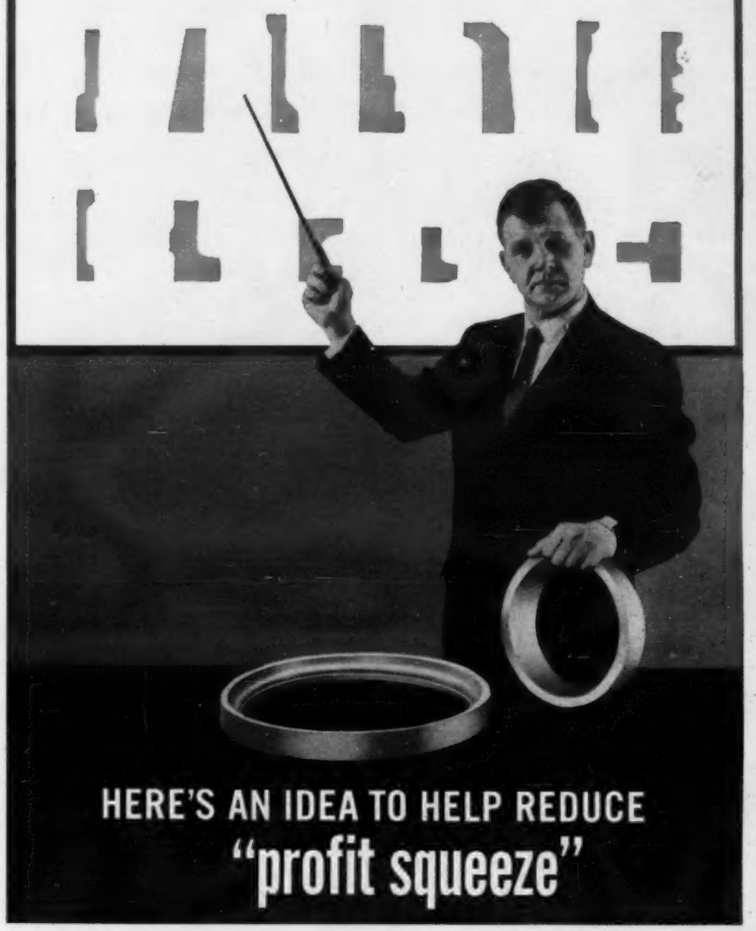
MAXIMUM NOMINAL TORSIONAL SHEAR DESIGN STRESSES

Company	BHN	Maximum Nominal Stresses	Stress Cycles from S/N Curves	
			K_f=1.0	K_f=2.0
A	302	78,000	1,000	1,000
B	555	100,000	8,000	3,000
		128,000	1,000	1,000
C	555	82,700	60,000	8,000
D	555	81,500	80,000	9,000
E	555	60,000	1,000,000	35,000

Table 1

Abstracted from technical paper No. 359D; $1; to SAE members, $0.75. Society of Automotive Engineers, Inc., 485 Lexington Ave., New York 17, N.Y.

Typical profiles of Edgewater Rolled Steel Rings



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Buy rings that are formed so close to finished shape and dimensions that very little machining will be needed. The result—less labor, less scrap loss, lower overall cost.

Edgewater rings are forged from solid blocks of steel, and rolled by a powerful ring-rolling mill to required cross-section shapes (see typical profiles above). Close tolerances minimize finishing operations.

Edgewater rolled steel rings are of uniform quality, strong and tough. Diameters: from 5 to 145 inches. Send drawings for recommendations and prices.

INTERESTING description of the ring-rolling process is given in this brochure, **Edgewater Rolled Steel Rings.** We will be glad to send you a copy.

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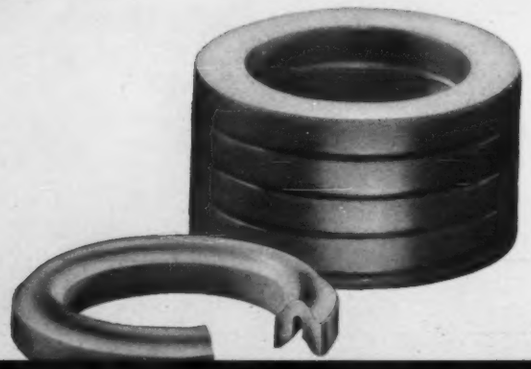
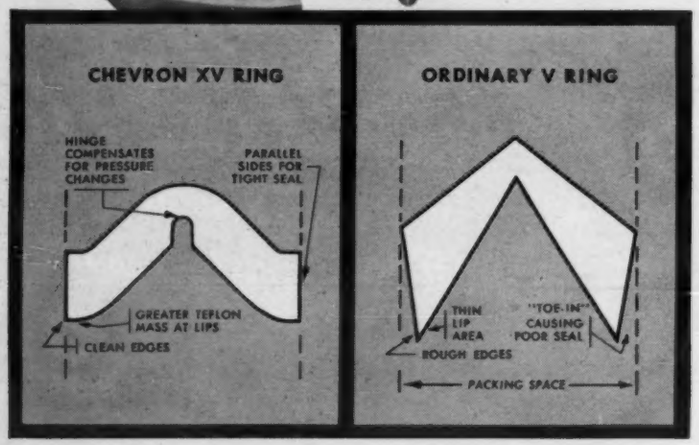
for Hydraulic, Pneumatic Service





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Can be molded precisely. The greater material mass of CHEVRON XV permits molding to consistent close tolerances ring after ring—batch after batch. Result—perfect fit, clean lips, far better sealing.

Ends frequent gland adjustment. The exclusive CHEVRON hinge compensates for pressure changes automatically. With proper installation, further adjustments are eliminated.

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Virtually ends friction because of two factors. First, Teflon has the lowest coefficient of breakaway and running friction of any solid material in use today. Second, the exclusive CHEVRON hinge action permits free operation with minimum friction at all pressures.

Learn the full story of this superior new packing. Discuss your particular needs with your Garlock representative. Call him at the nearest of 26 Garlock sales offices and warehouses throughout the U.S. and Canada. Or, write for Catalog AD-192, Garlock Inc., Palmyra, New York.

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Reliability in Space

E. D. Karmiol and J. S. Youtcheff,
Missile & Space Vehicle Dept.,
General Electric Co., Philadelphia, Pa.

The key to survival in space is dependent upon the reliability of the equipment utilized and the ability of man and equipment to complement each other in fulfilling the operational requirements.

The Space System Complex

All ventures into the thresholds of space to date have been concerned with equipment reliability. With the extended development of space exploration, it is necessary to consider man as part of the system complex. He can exercise decision-making capability as necessary throughout the mission.

It must be realized that the presence of man in the system creates new survival problems. Man must be protected from surrounding stresses, and an acceptable artificial environment maintained. This will necessitate special environmental control equipment which in many cases will reduce the strain on the operational equipment as well as man.

It can be seen that the reliability of the overall space-system complex is dependent upon man, the environmental control equipment and the operational equipment. These three vital elements make up an integral equipment loop in assuring mutual survival and adequate functioning of the space-system complex.

The Space Operation

The space vehicle operation can be divided into three distinct phases: the initial or launch phase, the space flight phase and the terminal phase. These phases can be further divided into subphases of powered flight, free-flight, approach and contact. The launch phase can consist of one or more stages of active propulsion, terminating at engine shutoff which occurs after a specified time period when vector velocity is reached. The space flight phase extends from engine cutoff to the time at which the vehicle enters the effective atmosphere. The terminal phase extends from this point

(Continued on page 77)

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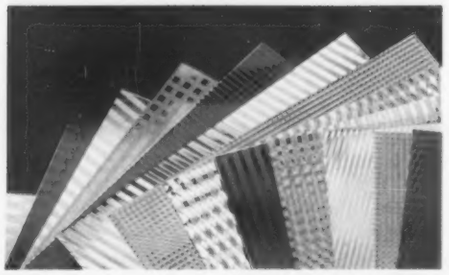

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Most of American Nickeloid's pre-plated metals are available in three forms . . . sheets, strips, and coils . . . to insure the greatest possible flexibility in fabrication. You also have a choice of finishes . . . mirror-like bright, or soft-sheen satin.

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Speeds Production from Metal to Shipping Carton!

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Wonderful virtuosity is yours when you select from American Nickeloid's tantalizing assortment of rippling crimps, ingenious patterns, luxurious textures, and pleasant stripes . . . all built into the metal before fabrication!

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CHROME BRASS	COPPER ZINC
NICKEL COPPER	POLISHED BRASS
CHROME COPPER	LAMINOL
NICKEL ALUMINUM	(Vinyl-metal laminates)

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Pre-plated American Nickeloid is the ideal finish for food servers, toasters, lighting and lamps, toys and novelties, displays, curtain rods, kitchen appliances and canister sets, stoves and heaters, and trim on washing machines, hardware, water heaters, clocks, desk accessories, giftwares, coffee makers, brushes . . . in fact, wherever decorative metal is sought!

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of atmospheric entry to the point of surface contact.

In each of these flight phases, the environmental stresses can be estimated analytically for component groups.

It is then possible to establish the stress levels for the various environments to which the system, and associated equipment, will be subjected in the several phases of the space flight operation. The time periods at the various stress levels, and the equipment functional requirements within these time phases, can be used with available design and test data in the prediction analysis.

Assuring Survival in Space

Space vehicle reliability must initially be provided for in the equipment design. There are several design approaches that should be followed to maximize system reliability attainment. One of the first design approaches that must be taken is the reduction of system complexity.

The selection of the most reliable parts available for the application is obviously of utmost importance in designing to achieve high reliability. To prevent catastrophic failure of component parts, the stress/strain distribution should never be allowed to overlap. The technique of part derating can be utilized effectively to reduce the operational failure rates of the circuit elements. Packaging can be employed to minimize environmental stresses on circuit elements.

The design approaches necessary to maximize the operational reliability of the space-system complex must consider human usage, ease of maintenance and psychobiological factors.

To assure design adequacy, four basic test activities should be carried out in the space-vehicle development program. These are design-qualification testing, equipment-acceptance testing, field testing and flight testing.

Equipment acceptance requirements include specific temperature and vibration testing to insure the detection of workmanship defects and incipient flaws in the production items.

In predicting system survival under the various environmental stresses, test data are accrued from all functional and environmental tests performed on both development and operational equipment. The prediction analysis can employ a sequential life testing plan using equipment test data as accrued throughout the development program. A mechanized program can be established to provide for the efficient handling and processing of all data necessary for the adequate analysis of equipment reliability.

Abstracted from technical paper ARS No. 61-164-1858; American Rocket Society, 500 Fifth Ave., New York 36, N.Y.

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● Shut off and 4-way valves in ¼, ⅜ and ½ inch port sizes are rated for 10,000 P.S.I. liquid or gases. They will withstand surges of up to 15,000 P.S.I. without damage to the valves' sealing qualities (designed for a burst pressure of 30,000 P.S.I.).
Solenoids are available for 115, 230 and 460 volt A.C. operation.

● Long maintenance-free service is achieved through the leak-proof "Shear-Seal" design. Optically flat metal to metal sealing surfaces (of the self-aligning sealing rings and the mating rotor face) are protected by staying in constant intimate contact: flow is always through the center of the "Shear-Seals," never across sealing surfaces. Sealing qualities actually improve as the seals lap themselves to a more perfect fit with each valve operation. There is no external shaft leakage because the pressure is confined to the flow passages.

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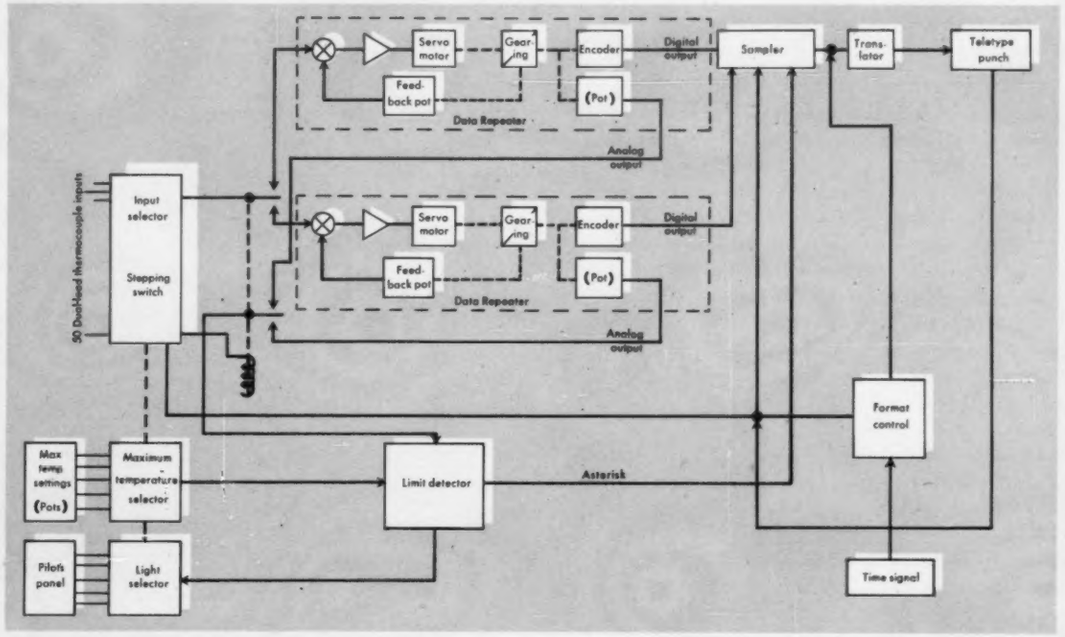
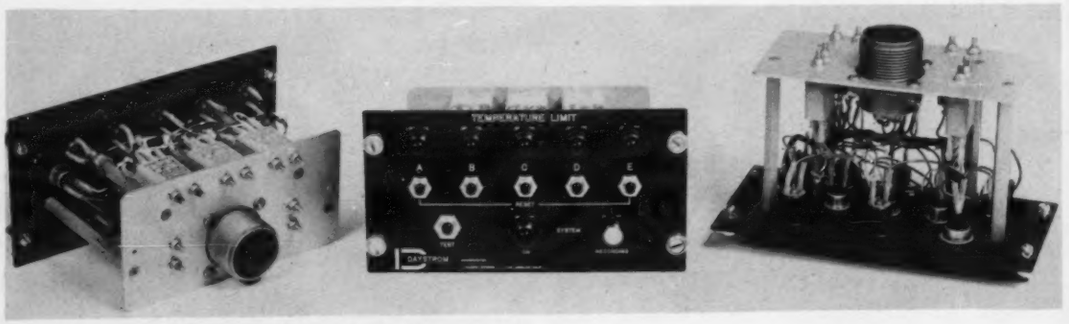
Dual Data Repeaters Speed Temperature-Sampling Rate

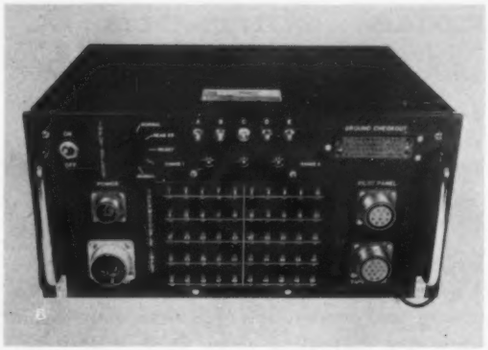
Edward W. Schrader, Western Editor



SYSTEM BLOCK DIAGRAM. Stepping switch sequentially supplies thermocouple inputs alternately to data repeaters. Each closed servo loop data repeater consists of null-seeking bridge (one arm of which is shunted by balancing potentiometer), an error amplifier and servomotor. Feedback potentiometer is tapped and shunted for linear relation between temperature and angular rotation. Data-repeater output shaft is ganged. Potentiometer gives analog output and shaft encoder gives digital output. Analog output furnished to limit detector is compared with maximum temperature selected for that channel. If temperature is exceeded, pilot's panel lights, and asterisk is placed on teletype tape for rapid recognition in printout. System is synchronized by ground pulses generated at tape punch drive motor cam switch.



PILOT'S PANEL has five lamps to indicate when temperature is exceeded on channel and corresponding five reset buttons.



SYSTEM CONTROLLER has patchboard thermocouple inputs. Five potentiometers set maximum temperatures on 50 channels. Each pot controls 10 channels. Junction error is minimized by providing uniform temperature area for electrical conductor material transpositions in circuit from patchboard to stepper switch to null-seeking bridge in each data repeater.

Two closed servo loop data repeaters share their outputs to increase the system sampling rate. The airborne temperature-recording system accepts up to 50 thermocouple inputs and provides output signals in code form for input to a teletype tape punch. The standard sampling rate is two channels per sec.

The system operates continuously. While one data repeater is seeking its null-balance, the digital output of the other data repeater is being punched into teletype tape. At the end of a temperature test, which may be for as long as three hr on a single 8-inch by 5/8-inch roll of tape, the punched tape may be placed on a standard teletype machine for wire transmission to the laboratory for analysis.

The printout is in the form of a four-digit time reference column plus 50 (or 25) columns of three-digit actual temperature values. The system is faster than chart recorders.

Designed for use with iron-constantan thermocouples, the standard temperature range is 220K to 875K on one servo repeater and 220K to 575K on the second servo repeater. Accuracy is 1/2 percent of full range.

The Multipoint Airborne Temperature-Recording System is a development of Orion Instruments Div. of Tamar Electronics, Inc., Los Angeles, Calif.

Time signal	1	2	3	4	5	6	7	8	9	10	11
0030	875	575	875	575	299	298	287	298	417	434	528
0030	875	575	875	575	299	298	287	298	417	434	528
0030	875	575	875	575	299	298	287	298	417	434	528
0030	875	575	875	575	299	298	287	298	417	434	528
0030	875	575	875	575	299	298	287	298	417	434	528
0030	875	575	875	575	299	298	287	298	417	434	528
0030	875	575	875	575	299	298	287	298	417	434	528
0030	875	575	875	575	299	298	287	298	417	434	528
0030	875	575	875	575	299	298	287	298	417	434	528
0030	875	575	875	575	299	298	287	298	417	434	528
0030	875	575	875	575	299	298	287	298	417	434	528

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new "Armalon" FEP-fluorocarbon resin coated glass fabrics

After extensive development and testing, Du Pont now can offer "Armalon" FEP-fluorocarbon resin coated glass fabrics. The FEP resin has unique properties that enable this new "Armalon" to find applications in areas not appropriate to our regular TFE line of "Armalon".

Outstanding advantages of new "Armalon" FEP

- Uniform porosity resistance
- New lower melt point for easier lamination
- Good heat resistance
- Extreme toughness
- Abrasion resistance
- Excellent electrical properties over a wide range of temperatures and frequencies
- High degree of chemical inertness
- Smooth, anti-adhesive surface with anti-stick qualities

Comparison of properties of new "Armalon" FEP and "Armalon" TFE

PROPERTIES	FEP 503-108	TFE 403-108	FEP 505-112	TFE 405-112	FEP 506A-116	TFE 406A-116	FEP 510-128	TFE 410-128
Breaking Strength	65 x 40	45 x 35	130 x 65	75 x 60	160 x 160	90 x 90	260 x 220	200 x 175
Tear (Elmendorf)	16 x 6	10 x 5	21 x 8	15 x 10	13 x 14	12 x 12	49 x 39	40 x 40
Moisture Absorption	.23	.64	.18	.68	.30	.32	.276	.10
Burst	150	25	200	25	380	100	410	100

Characteristics of new "Armalon" FEP

The "Teflon" FEP-fluorocarbon resin coating on "Armalon" FEP gives this new material several outstanding properties (not provided by "Armalon" TFE). For example, the FEP resin has a lower melt point (545°F. to 563°F.) than the TFE resin. This recommends the use of "Armalon" FEP as a coating on glass fabrics that are to be heat-sealed. In addition, FEP dispersion-coated glass fabrics have lower permeability, greater breaking strength and lower moisture absorption than "Armalon" TFE.

You may want a material that doesn't crack when creased under moderate pressure. "Armalon" FEP won't. There is no known solvent for its FEP resin coating, and it is unaffected by aqua regia and all known chemicals except molten alkali metals. Corrosive materials and atmospheric conditions have no effect on it.

"Armalon" FEP remains flexible after long exposure to high temperatures, and pliable at temperatures lower than -100°F. Of particular significance are the improvements in burst strength and moisture absorption in the higher resin, lower glass qualities (see Qualities 503-108 and 505-112).

Suggested uses for new "Armalon" FEP

An important use for new "Armalon" FEP is in the wrapping and fusing operations for pipe covering, roll covering and chemically resistant containers. We also recommend these new materials for gaskets and specialized diaphragms, because of their satisfactory levels of uniform porosity resistance.

Industries that should find new "Armalon" FEP useful are aircraft, chemical, food processing, packaging, paper, plastics, printing, rubber, textile and various other industries.

FOR EXAMPLE: Conveyor belts used in baking, candy and food industries where sanitation and ease of release are important—Non-sticking covers for heat-sealing bars on packaging equipment—Diaphragms for regulators and control instruments where heat and chemical resistance are required. These are a few suggested uses for new "Armalon" FEP—there are many, many more. What application does this new product suggest to you?

For complete information on new "Armalon" FEP, its application and uses, write: E. I. du Pont de Nemours & Co. (Inc.), Fabric Sales, Wilmington 98, Delaware.

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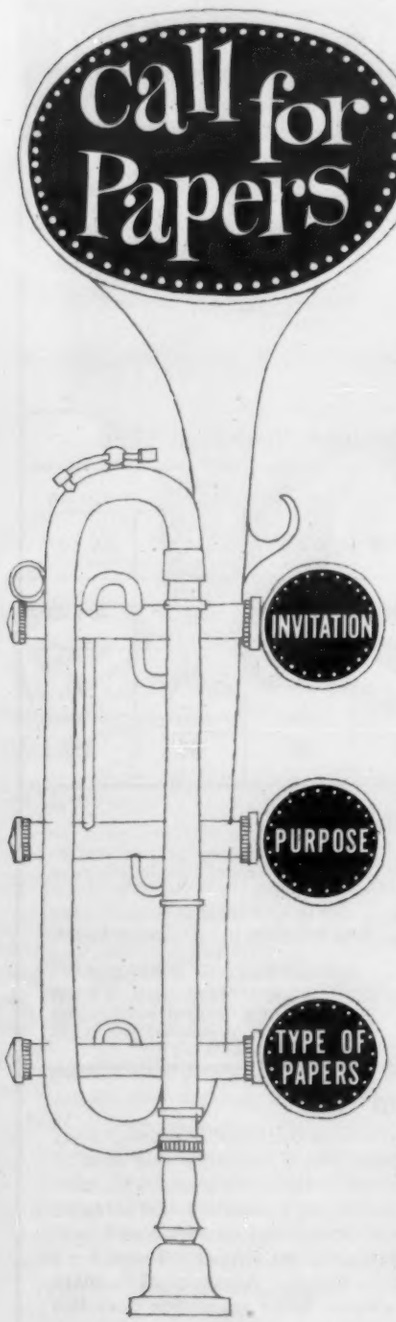

3rd INTERNATIONAL ELECTRONIC CIRCUIT PACKAGING SYMPOSIUM

You are invited to submit a paper for presentation at the Third Symposium on Electronic Packaging Techniques, sponsored by the University of Colorado, EDN (Electrical Design News), and Design News. The meeting will be held August 15-16-17, 1962 on the campus of the University of Colorado in Boulder, Colorado, the week preceding the Wescon Show in Los Angeles.

This is a noncommercial, technical education program geared specifically to engineers in all phases of electrical and electronic circuit packaging. Selection of each paper will be determined by the range of its subject matter and its contribution to circuit packaging. Areas covered will extend from the microscopic to the macroscopic, with special emphasis on packaging materials, packaging for outerspace, packaging for appearance, underground and underwater packaging, interconnections in packaging, and packaging economics.

General papers covering overall packaging concepts as well as papers dealing with specific designs are desired. Titles of proposed papers accompanied by individual explanations of about 500 words generally outlining the subject matter are requested at this time. Such an indication of a possible paper to be submitted will not place the author under any obligation, but will be helpful to the committee in planning the technical program.

A formal "Proceedings" of the Symposium will be published.

DEADLINE: THE FINAL DATE AFTER WHICH PAPERS CAN NOT BE CONSIDERED IS JANUARY 10, 1962.

Send your proposed paper to:

(IN TRIPLICATE)

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UNIVERSITY OF COLORADO
EDN Design News
ELECTRONIC PACKAGING SYMPOSIUM

Valve Controls Temperature,

R. F. Stengel, German Editor

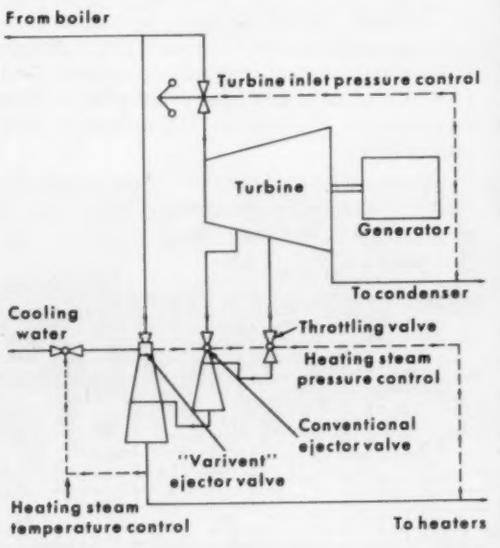
A valve with ejector action is the key component of a control system for simultaneously regulating pressure and temperature of turbine waste steam. Admixture of cooling water in the "Varivent" valve controls temperature, while pressure is held constant by a sequence-controlled set consisting of a throttling valve, a conventional ejector valve and a "Varivent" ejector valve.

A primary field of application is in chemical process installations where turbines operate under varying load and exhaust conditions, while downstream heaters require steam at constant pressure and temperature.

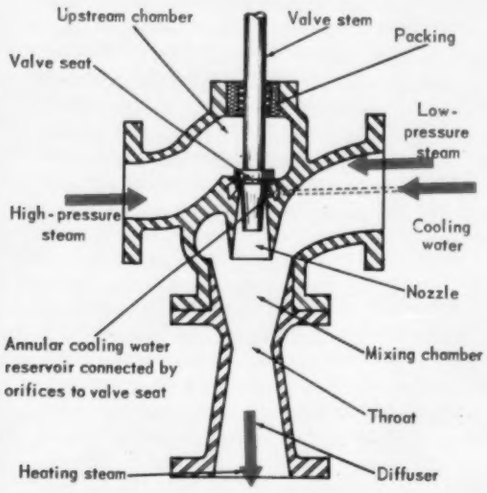
Waste steam for heating is usually tapped from the turbine at a point between intake and exhaust. At peak turbine load, the tapping pressure is too high for heater operation and is reduced in a throttling valve adjusted by feedback of the downstream pressure.

As turbine load is reduced, a separate feedback loop cuts turbine intake pressure. The resulting drop in tapping pressure is compensated by opening the throttling valve until it is in "wide-open" position. At this point, the sequence control begins to open a conventional ejector valve, which admits additional steam at higher pressure.

When turbine tapping pressure falls below the desired heater pressure, the sequence control admits steam from the high-pressure line into the



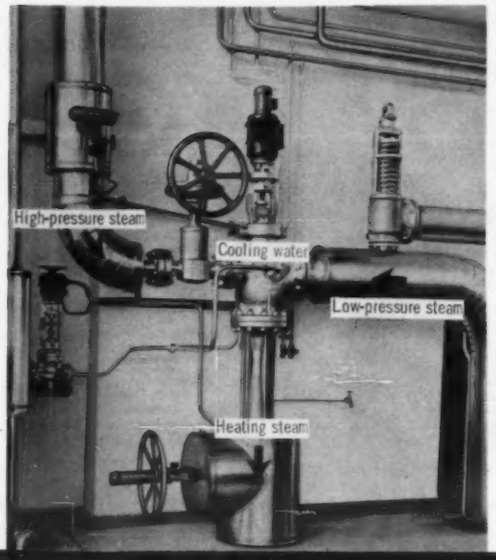
Pressure of Turbine Waste Steam

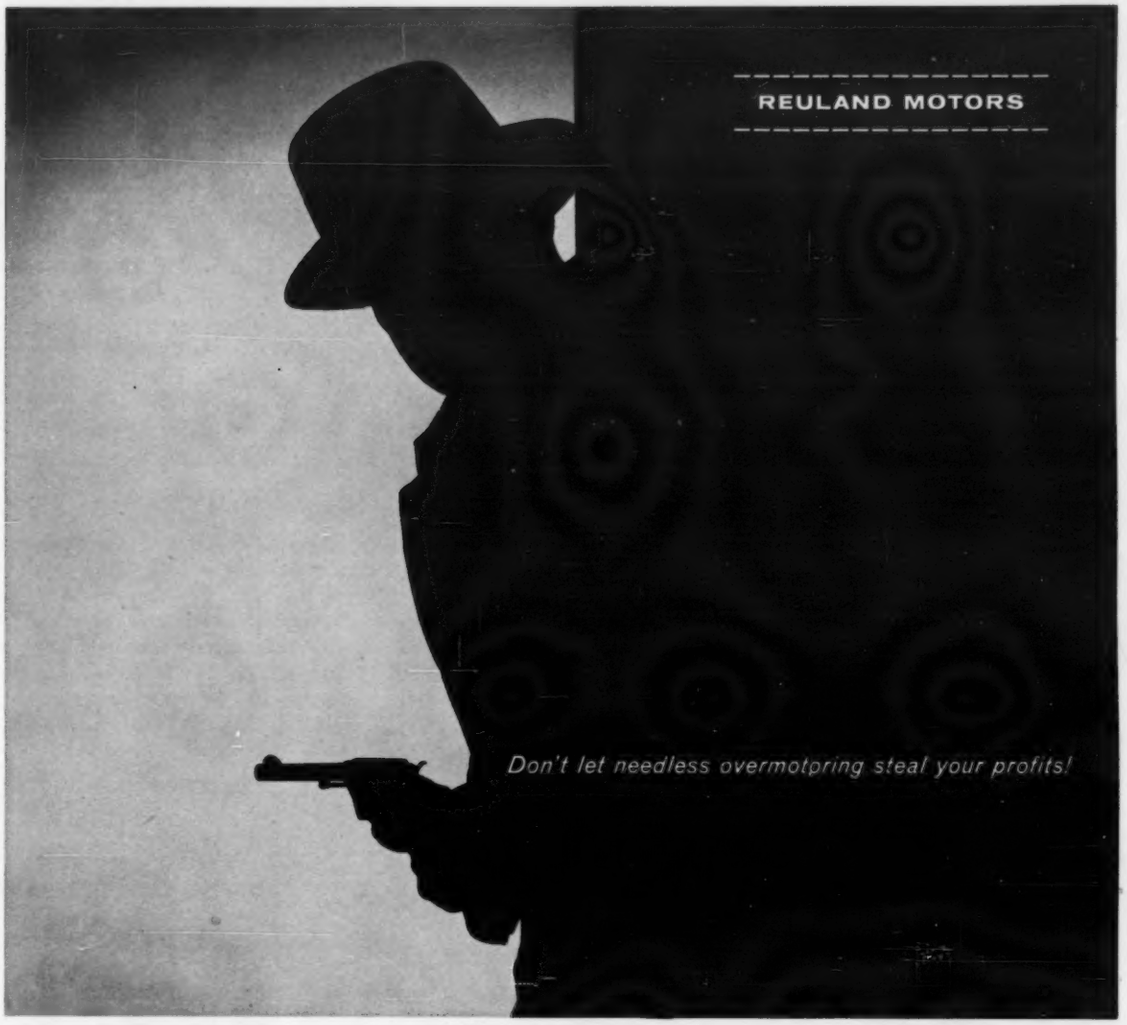


"Varivent" valve. Through ejector action, this added steam boosts downstream pressure to the required level. Resulting freedom in turbine operation is a major economic advantage.

Steam temperature control is performed independently by admitting cooling water to an annular chamber in the "Varivent" valve, which is connected through orifices to the high-pressure space. As high-pressure steam is accelerating into the control cross-section formed by valve cone and valve seat, it entrains cooling water and mixes with it thoroughly.

The "Varivent" steam ejector valve and control system are developments of Siemens-Schuckert-Werke AG, Erlangen, Germany.





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22½*	25	27½*	30
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*New intermediate ratings

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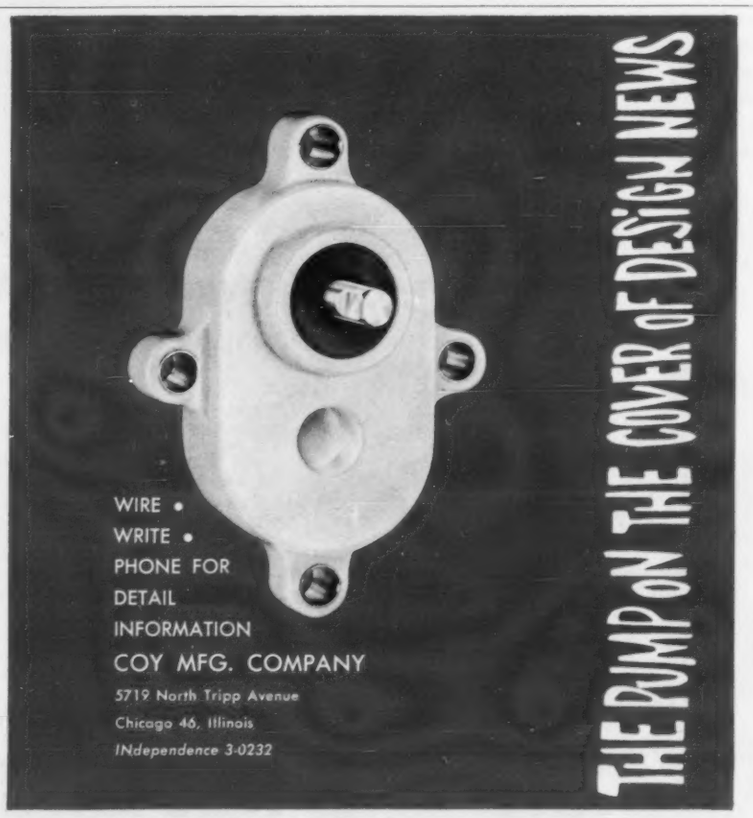
NEW BOOKS

PHILOSOPHY AND THE AMERICAN HERITAGE. Here is a book that brings the abstract field of philosophy down to earth—and more specifically, down to the problems facing America today. The theme of discussion is found in this quotation from the preface by the authors: "The continued life and health of a nation rest, we are persuaded, not solely on its military, economic and political strength and organization, but on the enthusiasm, intellectual vision, moral and religious commitment, and self-knowledge among its citizens." The authors believe very strongly that it is time this nation began to assess its heritage and the way we, as a people, fit into present-day civilization. They think of philosophy in the "Socratic" sense—as an analytical method of inquiry rather than a fixed set of beliefs or dogma. They then proceed to outline a number of thoughts about the kind of a philosophy that could be fashioned to express the American spirit in relation to our time. By Johnson D. Hill and Walter E. Stuermann; Philosophical Library, Inc., 15 E. 40th St., New York 16, N.Y.; 254 pages; $3.50.

USING THE OSCILLOSCOPE IN INDUSTRIAL ELECTRONICS. This book is directed primarily to technicians working in the electronics industry. The book assumes a basic knowledge of the operation and use of an oscilloscope and, using this as a point of departure, covers many of the uses of a scope which are somewhat more unusual. Liberal use of schematic diagrams, block diagrams and oscilloscope photographs is made. Chapters include magnetic amplifiers, transistorized controls, oscilloscope waveform photography and oscilloscope maintenance. By Robert G. Middleton and L. Donald Payne; Howard W. Sams & Co., Inc., 1720 E. 38th St., Indianapolis 6, Ind.; Catalog No. OSM-1; 256 pages; $4.95.



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ENGINEERING FUNDAMENTALS FOR PROFESSIONAL ENGINEER'S EXAMINATIONS. The subject of this book is, of course, close to the heart of many engineers. There is no attempt here to take the reader beyond the contents of the usual bachelor courses in engineering. Chapters include Mathematics up to Simple Integration, Mechanics to Simple Harmonic Motion, Fluid Mechanics as far as Lift and Drag Coefficients, Thermodynamics through Heat Transfer. Further chapters take up Mechanics of Materials, Electricity and Electronics, Chemistry. A short chapter on Engineering Economics is included. With each chapter is a rather extensive list of problems from past examinations with the answers given in an appendix. By Lloyd M. Polentz, P.E.; McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N.Y.; 366 pages; $9.50.

PROGRESS IN OPERATIONS RESEARCH is the first volume in a series of reviews which will inventory mathematical techniques and research methods for operations researchers. Separate chapters discuss eight important areas of operations research: inventory theory, linear programming, dynamic programming, queuing theory, sequencing theory, replacement theory, simulation and gaming. Each chapter evaluates the current "state-of-the art", discusses important applications, deficiencies and unsolved problems. In addition, an article discusses decision and value theory. The first and last chapters review recent progress in operations research on other than the technical level. Each chapter contains a selected bibliography. Edited by Russell L. Ackoff, Case Institute of Technology; John Wiley & Sons, Inc., 440 Park Ave. S., New York 16, N.Y.; 505 pages; $11.50.

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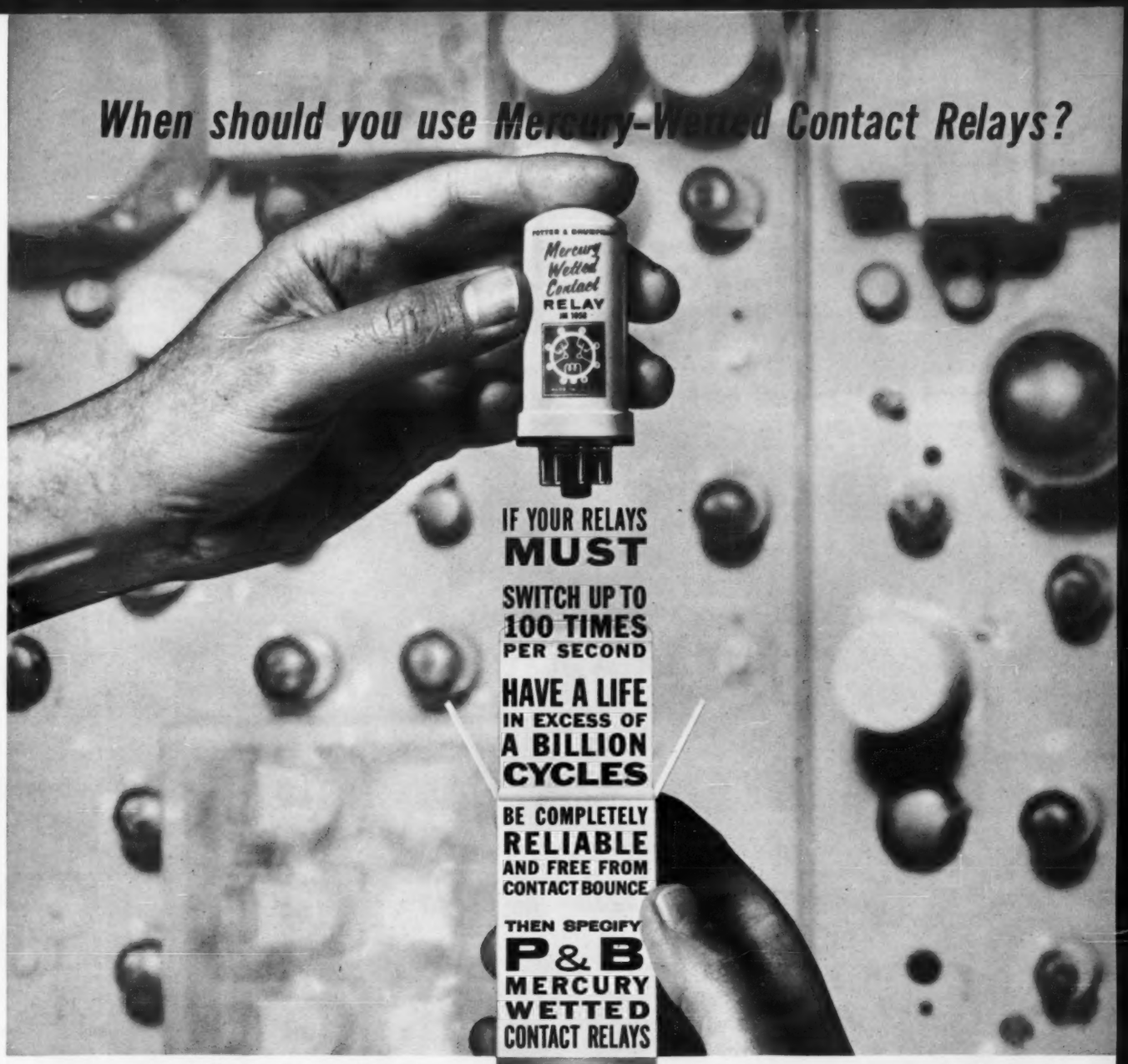
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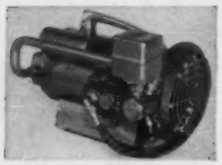

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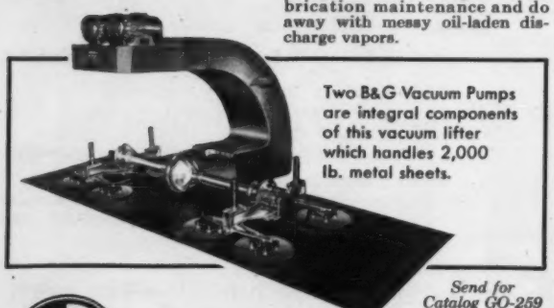

Two B&G Vacuum Pumps are integral components of this vacuum lifter which handles 2,000 lb. metal sheets.

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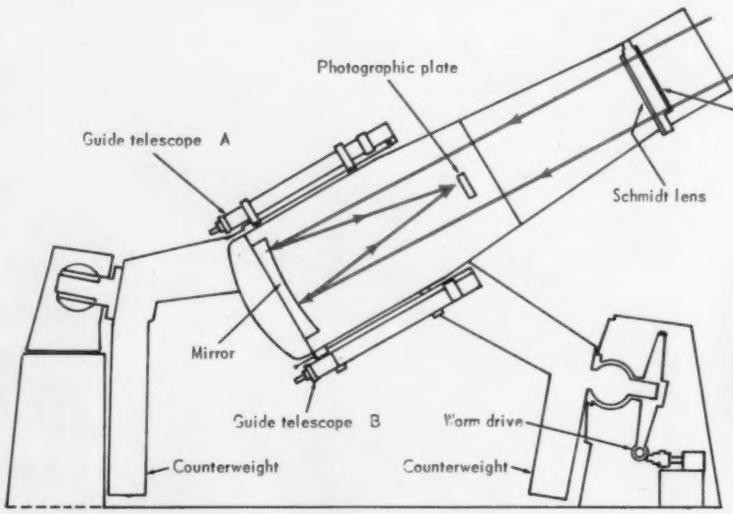
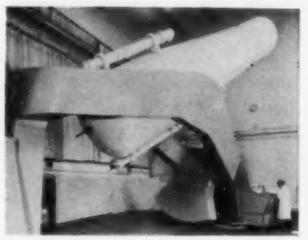
DESIGN NEWS IDEAS IN THE NEWS

Schmidt Reflector Telescope Features Novel Mounting





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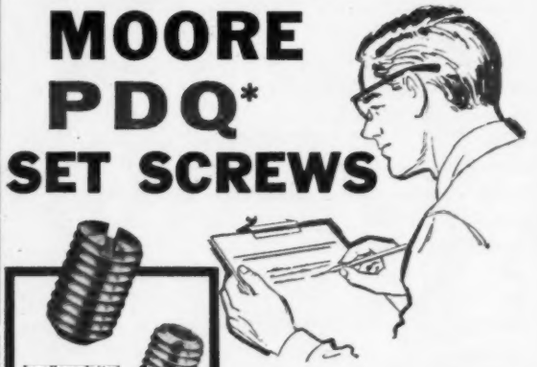

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A Schmidt telescope for Caracas, Venezuela, incorporates solutions of two major design problems. The low latitude of its destination led to a new arched-yoke type of mounting, while optical performance tolerances called for a novel support system of the 1-ton mirror.

Telescope mounts are designed to align the major turning axis with the celestial polar axis. This axis therefore is inclined to the horizontal at an angle equal to the latitude of the location. Most large telescopes are in temperate-zone countries, and conventional telescope mounts are designed for latitudes of 40 to 50 deg. Since the Cagigal Observatory has only a latitude of 10 deg 30 min N, the polar axis of the telescope is inclined unusually far toward the horizontal.

The new mounting consists of a box frame with a pronounced upward arch of its longitudinal members. The frame is welded from sheet steel; stiffness is sufficient to keep deflection to 0.8 mm at 12-ton load. To each end of the frame is flanged a 700-mm-dia sphere ground to optical tolerances. The spheres rest in spherical journal bearings on an 0.1-mm-thick oil film which supports the 28-ton weight of telescope, frame and counterweight. An automatic pressure control unit, compensating for temperature effects on oil viscosity, keeps film thickness within a $\pm$ 10 μ range for a maximum polar axis tilt of $\pm$ 0.5 sec.

The sphere at the south (low) end of the polar axis is connected rigidly to the frame and absorbs the axial component of the weight. The opposite sphere is axially movable on a pivot for assembly and longitudinal adjustments. Bearing friction is low; for tracking, the telescope is rotated around the polar axis by a 40w synchronous motor with quartz-clock-controlled frequency.

The frame is turned by means of a worm and a 360-tooth worm gear. The worm is coupled rigidly to a lubrication oil pump. Gear-tooth spacing is accurate to 0.0045 mm or 1 sec. For rapid frame rotation up to 60 deg per minute, a 200w motor drives an infinitely variable transmission which gradually accelerates and decelerates rotary motion.

Tracking is fully automatic. A timing unit receives quartz clock signals. Right ascension of the star to be observed is preset on the control desk. Telescope position is monitored at the worm drives for polar axis and declination axis. Position signals are compared with the preset required position, as determined by time signal and right ascension. Discrepancies are used to drive a servomotor which returns the telescope to track.

The Schmidt telescope, third largest in the world, was designed by Askania-Werke, a subsidiary of Continental Elektroindustrie AG., Berlin, Germany.

R.F.S.

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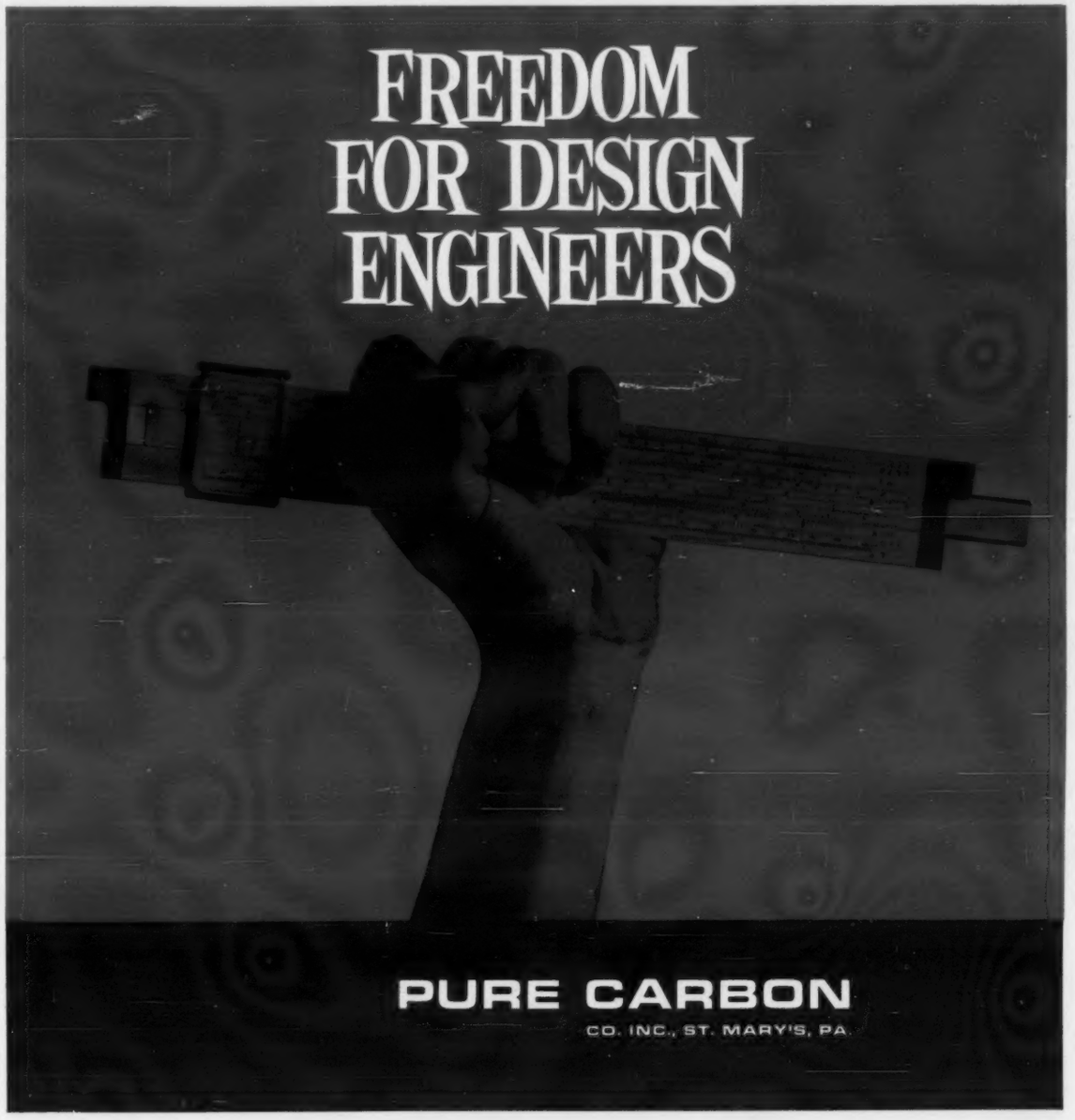

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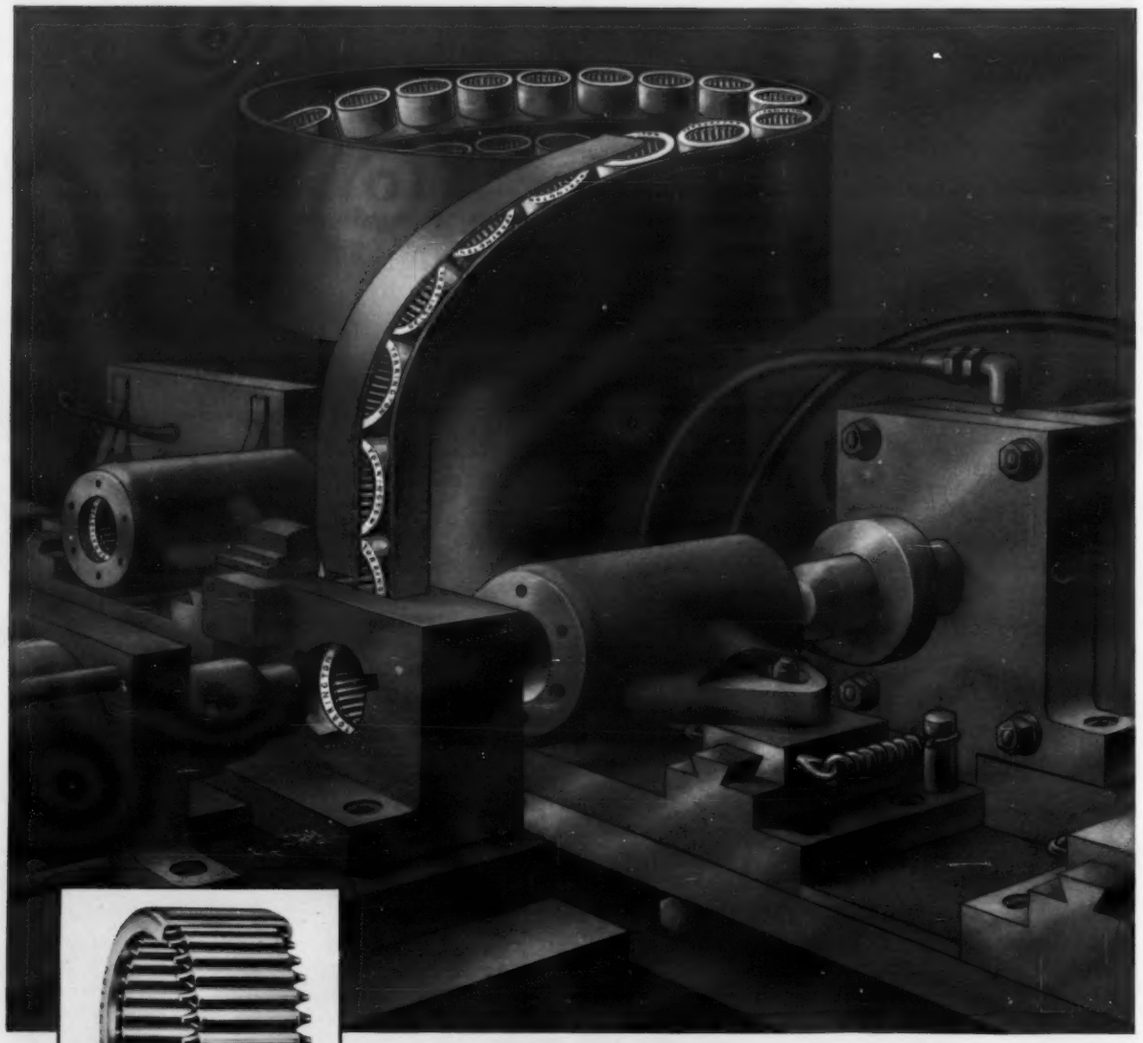

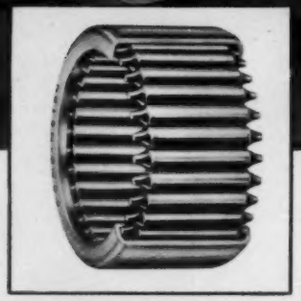

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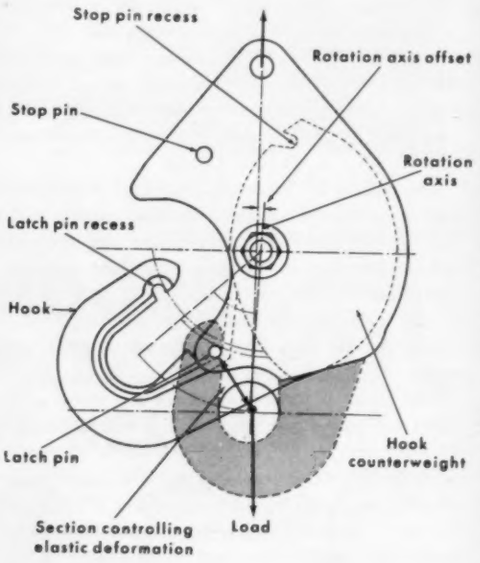
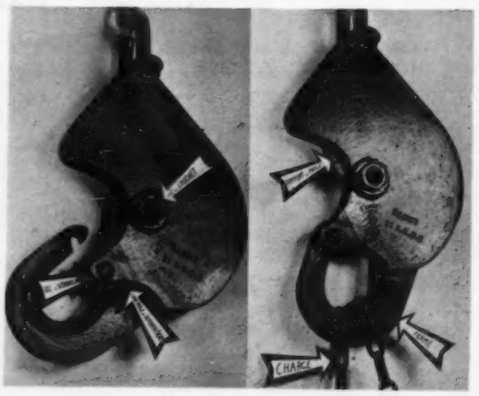
IDEAS IN THE NEWS

• **ELASTIC DEFORMATION** of a crane's hook latches it automatically as load is applied. Aside from this safety feature, better stress distribution, resulting in higher carrying capacity, is claimed.

Unloaded, the hook is swung open around its rotation axis by a counterweight. Application of load turns the hook until a recess slides over a stop pin in the housing. In this position the latch-pin recess in the hook tongue is above the latch pin in the housing.

Further increase of load elastically deforms the tongue, seating the latch pin recess and transferring some load to it. The hook cannot be opened until the load is released. Proper deformation is aided by a slight offset of the main rotation axis from the load-suspension center line. The unit is manufactured by Mrs. André Henry and Co., Rouen, France. **G.B.B.**





Circle 98 on Reader-Service Card for more information

got a
SPRAY NOZZLE
problem?

perhaps one of our **DATA SHEETS** *can suggest a solution*

For almost every spraying application, there's a Spraying Systems Data Sheet that gives useful information on suggested installations and types of nozzles to use. If you have a problem, write and let us know the application involved . . . and we'll send the Data Sheet that applies.

SPRAYING SYSTEMS CO.
3241 RANDOLPH STREET • BELLWOOD, ILLINOIS

And . . . for complete spray nozzle information, write for Catalog 24.

Circle 99 on Reader-Service Card for more information

• **NEW THEORY** of human color perception represents the first complete mathematical formulation of the behavior of any of the human senses. The theory is important for a wide variety of applications where color is utilized—such as photography, television, data display systems and meteorological satellites and other space surveillance vehicles.

Addition of color perception to the capabilities of meteorological satellites would enable them to provide certain types of information, of extreme importance to many space programs, that otherwise would be unavailable. Color data from a sensory device in the satellite now can be processed in a manner similar to the way the human eye treats the information. Thus, it would be possible to identify the true color of an object regardless of the nature of the illumination it receives. This interpretation of color data may help in distinguishing cloud cover from land masses when viewed from a satellite.

The mathematical theory was formulated at the Applied Research Lab. of Sylvania Electronic Systems, Div. of General Telephone & Electronics Corp., Waltham, Mass. It was developed during studies of man's sensory perception and thought apparatus, studies that were directed toward linking man to advanced communications systems.

Famous PRATT & WHITNEY AIRCRAFT J57 Jet Engine, power plant for Air Force "Snark" guided missile, is geared for both commercial and military performance by *Perkins*. Typical tolerances on *Perkins* gears: .0004 tooth to tooth; .0015 cumulative; .0005 on involute. On spline: .0006 tooth to tooth; .0008 cumulative; .0005 on involute. Most *Perkins* gears are carburized, hardened and ground.

PRECISION
for top-flight performance!

Rigid PRATT & WHITNEY AIRCRAFT precision requirements spell *performance* . . . top-flight performance. Reason: The future is at stake. And that future can well ride on gear-teeth. Since 1940, PRATT & WHITNEY AIRCRAFT gear tolerances have been *Perkins'* standards . . . for commercial gears as well as aircraft. Such precision pays off in longer wear, greater efficiency, lower maintenance cost. That type of precision can pay off for you, too.

This Handy Gear Calculator, easy to use, saves time. *Folder* illustrating Perkins custom precision gears and facilities offers information. Both yours on request.

PERKINS
MACHINE AND GEAR CO.

Dept. 54 West Springfield, Mass.
Telephone: REpublic 7-4751

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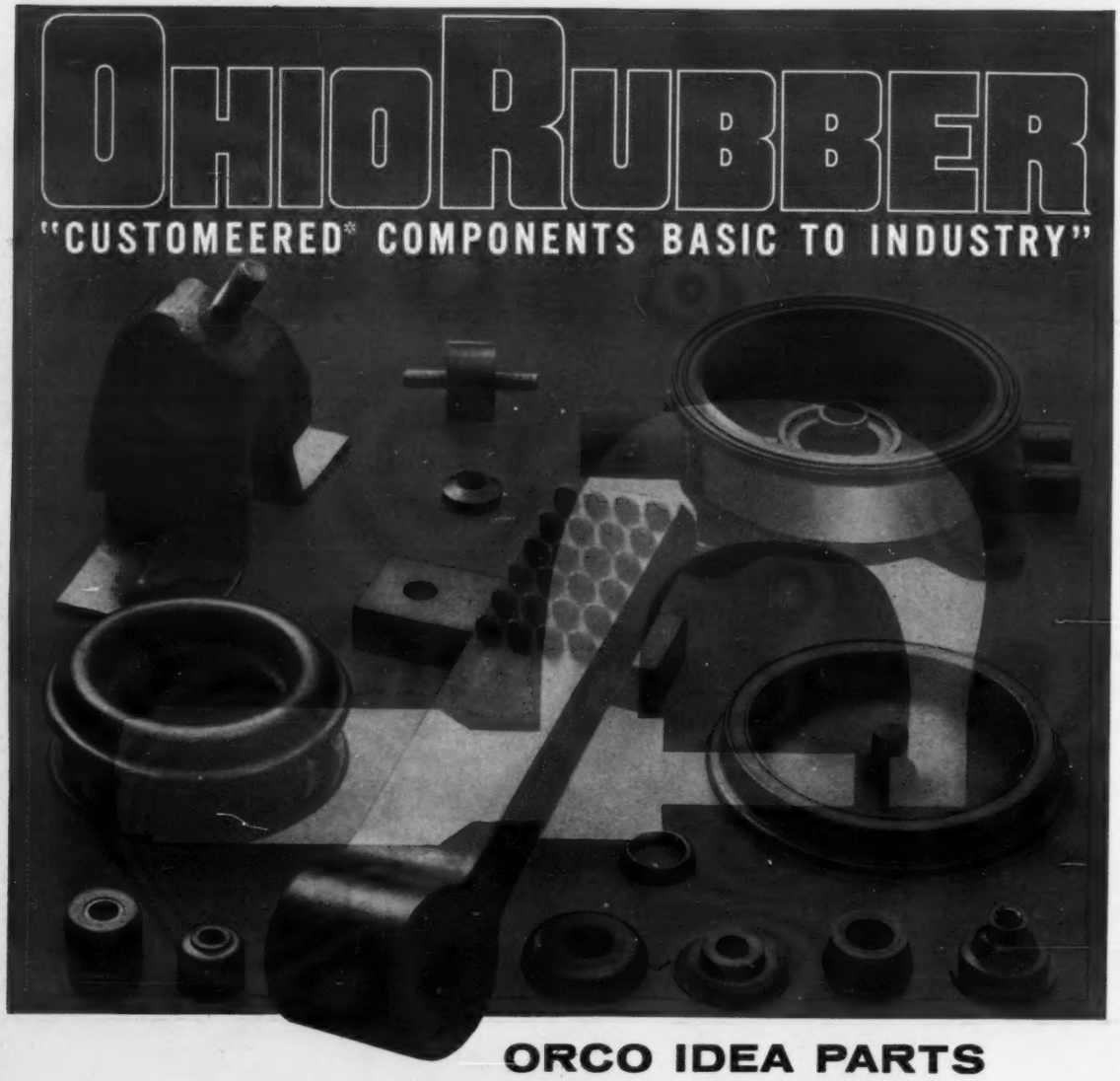

ORCO IDEA PARTS

shape up OEM designs—profitably!

OHIO RUBBER IS THE GOOD SOURCE FOR THE OEM!

ACROSS THE BOARD in industry, ORCO IDEA PARTS offer the design engineer product quality evolved from Ohio Rubber's years of experience in supplying "Customeered"* components for outstanding original equipment manufacturers nationwide.

ORCO CUSTOMEERING* is geared to cut production costs—to deliver a better part. And it goes to work for you as soon as performance requirements are checked, a materials recipe is formulated, expense-shaving design modifications, if necessary, suggested. The full scope of ORCO integrated design, research and practical ingenuity in custom-manufacture of rubber, synthetic rubber, silicone rubber, polyurethane, and flexible vinyl components is focused on your component.

ORCO CAPACITY offers the facilities of four modern plants. These include design, building, and maintenance of precision molds and dies . . . permanent bonding-to-metal . . . compression and transfer molding . . . extruding of all shapes, sizes, and types . . . complete laboratory facilities . . . statistical quality control . . . coordinated production control.

SUGGESTION — send for ORCO Bulletin 715 for the complete money-saving story of "Customeering". It's yours for the asking!

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A DIVISION OF THE EAGLE PICHER COMPANY

EAGLE EP PICHER

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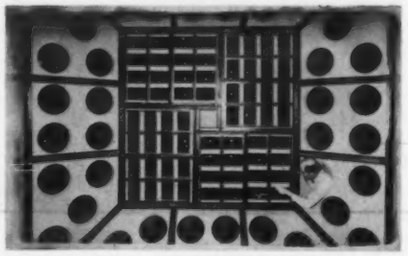
IDEAS IN THE NEWS



BAFFLE-ROOM VIEW of acoustic testing facility. Forty-eight circular speakers are "woofers". Sixty-four trumpet-shaped speakers are midrange speakers, but are termed "tweeters" because they are of highest range employed in installation.

• **SOUND**, produced by what is claimed to be the world's largest "hi-fi set" is used to prove the reliability of aircraft and missile parts by the Arizona Div., Goodyear Aircraft Corp. The set's capability ranges through frequencies from 37 to 10,000 cps.

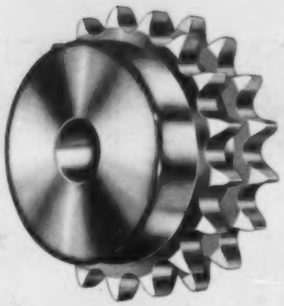
"Noise" is generated by passing electric current through a Zener diode. A technician controls the frequency spectrum of the noise from an instrument console and adjusts it to conform to the test in progress. Adjoining the control panel is an analyzer that permits the operator to verify the type of sound, its frequency in cycles and its level in decibels.

The test item is suspended within the inch-thick duraluminum walls of the test chamber on a rubber shock cord. A "sink" is bolted in place behind the chamber. The sink is a box filled with sound-baffling wedges of spongy urethane foam rubber that reduces the noise to levels bearable to ear-muffed technicians within the testing laboratory.

In addition to two square testing chambers, there is also a reverberant chamber, resembling a submarine. In this, objects are suspended in the 6-ft-dia as they are in the other chambers. Sound is fed into the tank through a side opening.

The curving walls of the tank permit technicians to carry out tests entirely different from those performed with the other two testing chambers. Sound entering the tank bombards the test subject time-and-again as the sound reverberates through the chamber.

Circle 103 on Reader-Service Card



STEEL HUB SPROCKETS for single or multiple width chains, completely machined to the highest standards.

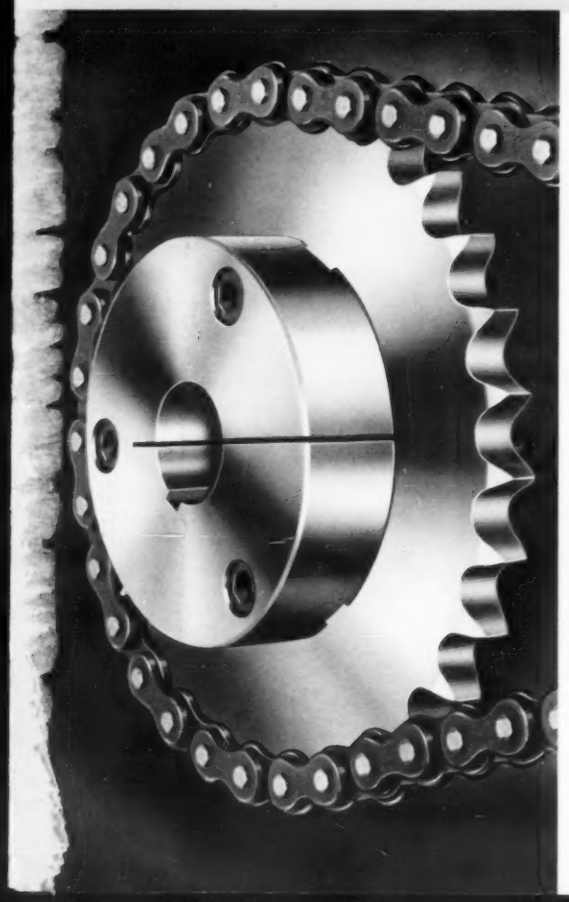
Everything in Chain Drives from A to Z

Cullman Sprockets and Roller Chains

You can be sure of meeting virtually every power transmission requirement with CULLMAN SPROCKETS AND ROLLER CHAINS — a complete selection of types and styles developed from almost 70 years' experience. Need specials? Here too, Cullman can serve you by manufacturing to your specifications. A national network of distributors and sales engineers, backed by regional warehouses, is always ready to serve you.

cullman wheel COMPANY

1344 Altgeld Street • Chicago 14, Illinois • BUckingham 1-2800



GRIP-MASTER® SPROCKETS —all steel construction, hardened teeth in pinion sizes, interchangeable hubs and bushings.

STEEL PLATE SPROCKETS for single or multiple width chains can be supplied plain, with drilled or tapped holes, counterbored or split.

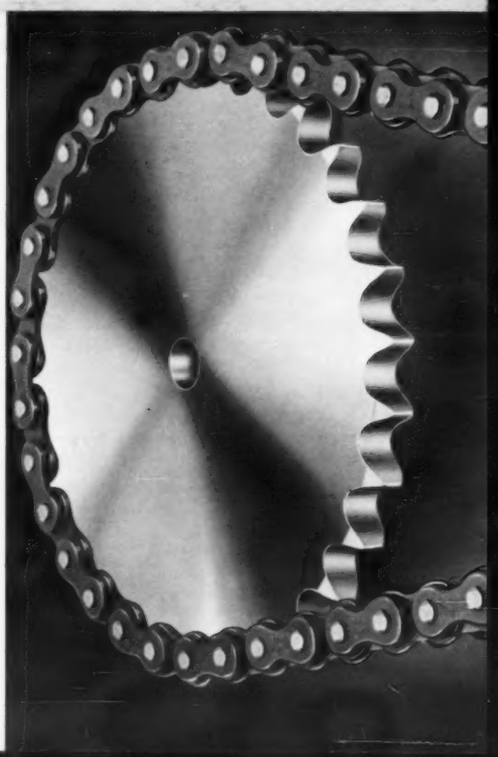
WRITE

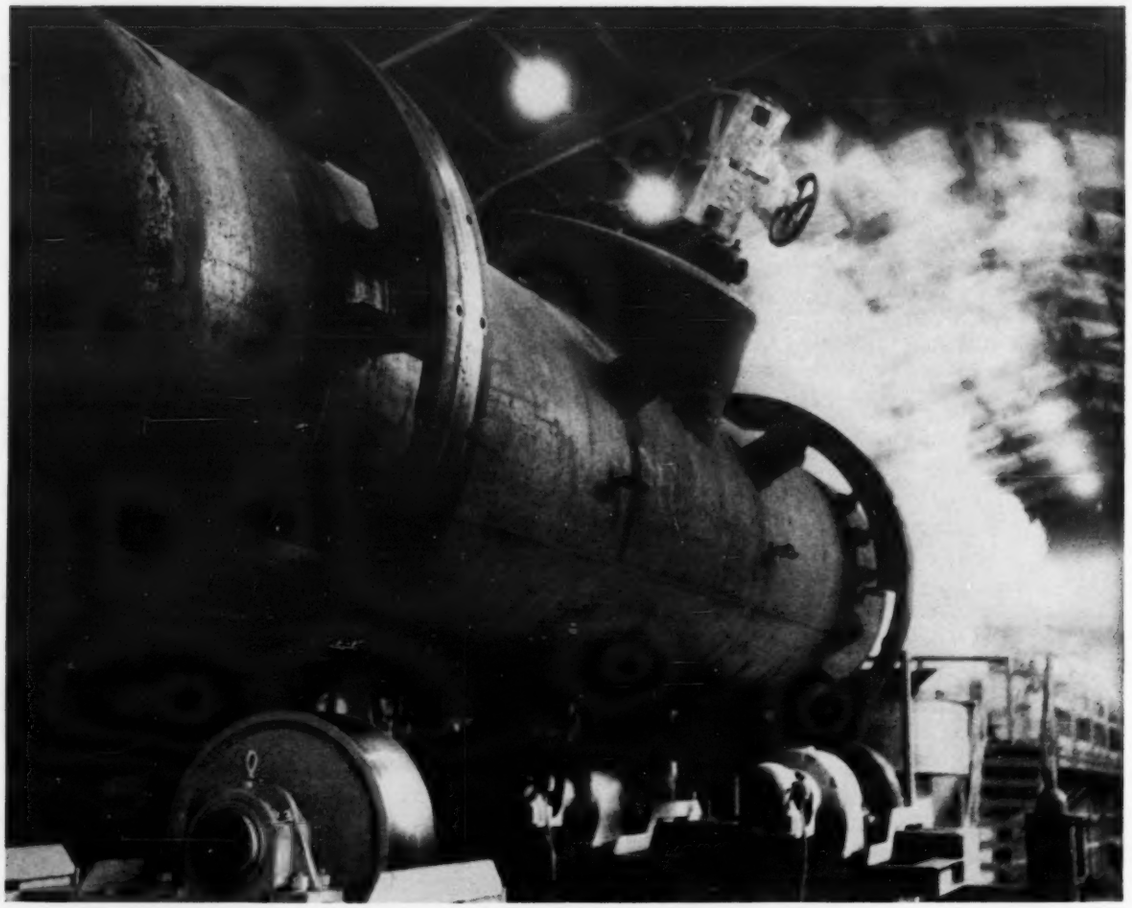
today for free Cullman literature . . . get assistance on your power transmission problems.

FACTORY WAREHOUSES AT

821 South Santa Fe Ave.,
Los Angeles 21, California
2618 Carnegie Avenue,
Cleveland 15, Ohio
205 North 11th Street,
Tampa 2, Florida

Roller Chain Drives Since 1893





The specialists at General American's Kanigen plant in Sharon, Pennsylvania can deposit an even coating of hard nickel alloy on most ferrous metals in common use. Regardless of how high, wide or heavy the object is, if you can get it to Sharon, we can plate its interior.

Before General American developed Kanigen coating, it was next to impossible to deposit an even nickel plating over very large surfaces or on many complex shapes. Since Kanigen nickel plating is purely a chemical process involving no electric current, it works equally well on simple or complex shapes and on small or large surfaces. Thickness uniformity of the coating is independent of part complexity or size.

IF YOU CAN SHIP IT WE CAN PLATE IT!

NO MATTER WHAT THE SIZE OR SHAPE OF YOUR PRODUCT, IT CAN BE COATED BETTER WITH KANIGEN® NICKEL ALLOY

Only General American and its authorized licensees around the world can show yo. how Kanigen coating may improve your product. The Kanigen process is protected by more than 30 separate patents. For detailed technical literature, write for bulletin No. 561.

Kanigen Division

GENERAL AMERICAN TRANSPORTATION CORPORATION

135 South LaSalle Street, Chicago 3, Illinois

KANIGEN GENERAL AMERICAN TRADE MARK

Offices in principal cities

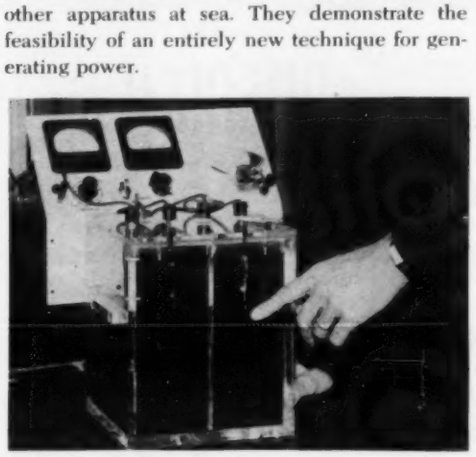
Circle 104 on Reader-Service Card for more information

• **THREE BASIC BIOPOWER DEVICES,** converting "life-energy" into usable electric power, have been built by Magna Products, Inc., Santa Fe Springs, Calif. The devices have been in operation for more than one year.

The first device is a biobattery that utilizes natural minerals and organic matter contained in ordinary sea water. Billions of bacteria consume these nutrients, producing an electrical potential between the poles of the battery.

The second type is the biofuel cell utilizing organic matter and air; the third, and possibly the most exciting type, is a biosolar cell which makes use of photosynthetic organisms that convert solar energy directly into electricity at efficiency levels that ultimately may be far above those achieved by any other known device.

The devices are already generating sufficient power to operate radio beacons, signal lights or other apparatus at sea. They demonstrate the feasibility of an entirely new technique for generating power.



• **ELECTRONIC SPACE-RADIATION DETECTOR** permits three-dimensional tracking of cosmic rays. The detector demonstrates the principles of a multiplate spark chamber system, which is said to permit faster tracking than other detectors such as the "cloud" and "bubble" chambers.

The spark chamber consists of a set of parallel conducting plates in a gas atmosphere. Alternate plates are connected to opposite sides of a high-voltage pulser which produces a potential of about 10,000v between each pair of plates. When a charged particle passes through the gas between the plates, it ionizes the gas atoms along its path. If a high-voltage pulse is applied between the plates shortly after the passage of the ionizing particle, the ionized path acts as a nucleus for the formation of a localized spark that jumps from one plate to the next. The sparks can be observed visually.

The detector was built by the Paul Moore Research and Development Center of Republic Aviation Corp.

ELECTRONIC

WAR TERMINATION INVENTORIES

WRITE OR WIRE FOR INFORMATION ON OUR COMPLETE LINE OF SURPLUS ELECTRONIC COMPONENTS. ALL PRICES NET F.O.B. PASADENA, CALIFORNIA

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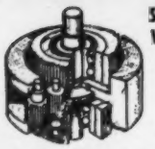
2176-E East Colorado St.
Pasadena 8, California
MUrray 1-7393



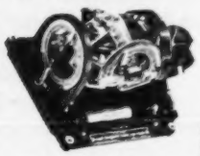
SIMPLE DIFFERENTIAL WITH BALL-BEARING SUN GEARS

The 1:1 reverse ratio spur gears are 48-tooth, 32 pitch brass with 3/16" available face. On one side, the shaft is 23.64" dia. for 11/16" and has a pin hole, then increases in dia. to .377" for the remaining 3/16" of length. On the other side, the shaft is .377 dia. ¼" lg. 2-13/16" dia. is required to clear the body.
Stock no. A6-115 ..... each $15.00

SIMPLE DIFFERENTIAL WITH SPACED-OUT SUN GEARS

1:1 reverse ratio spur gears are aluminum, 3/32" face, 32 pitch, 32 tooth on one side, 48 tooth on the other. The body is ¾" thick, but the sun gears are spaced out so that they are 1½" apart. ½" dia. shaft on each side is 23/32" long. OA length 3⅛". Requires 1-23/32" dia. to clear the body.
Stock no. A6-124 ..... each $4.50

HONEYWELL VERTICAL GYRO MODEL JG7003A-1



115 volts, 400 cycles, single phase, 35 watts. Pitch and roll potentiometer pickoffs 890 ohms, 40 volts max. AC or DC. Speed 20,000 rpm, ang. momentum 12,500,000 gm-cm ²/sec. Erection system 27 VAC, 400 cycles, time 5 min. to ½°.
Weight 5.5 lbs. Price $35.00 each

DIRECTIONAL GYRO

Mfg. Sperry Part #656519
115 VAC 400 N 3 phase
$35.00 ea.

8-DAY ELAPSED-TIME SURPLUS AIRCRAFT CLOCK

Here's an accurate time-control center that'll help you win your next rallye. It not only tells you the date and time of day right to the second, it's a stop watch that gives you elapsed time in seconds, minutes, and hours! The 24-hour clock simplifies adding and subtracting elapsed time for your navigator. Manufactured by Elgin Watch Co. to exacting military specifications, it will remain accurate in spite of road bumps and vibrations. Uses no electrical connections. Does the job of high-cost equipment. Jeweled/Sweep Second Hand/Luminous Hands and Numerals/25-Hour Dial/Black Face and Plastic Case/3⅛" Mounting.
Cost the Government $185.00
Only **$39.95** Postpaid

SPERRY VERTICAL GYRO

Part #653265, Motor 115 volts, 3 phase, 400 cycle, 8 watts, 20,000 RPM. 3-minute runup, synchro pickoffs, roll 360°, pitch 85°. Synchro excitation 26 volts, 400 cycle, 150 m.a. Vertical accuracy ±½°. Weight 3½ lbs. Approx. dim. 5¾" L., 4½ W., 4½" H.
Price $35.00

VARIABLE SPEED BALL DISC INTEGRATORS (All Shafts Ball Bearing Supported)

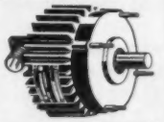
No. 145 Forward & Reverse 2¼"-0-2¼". Input shaft spline gear 12 teeth 9/32" dia. ⅛" long. Output shaft 15/64" dia. x 13/32" long. Control shaft 11/32" x ⅜" long. Cast aluminum construction. Approx. size 3" x 3" x 2¾" $17.50

No. 146 Forward & Reverse 4-0-4. Input shaft 5/16" dia. x ¾" long; Output shaft 15/64" dia. x 9/16" long. Control shaft 11/64" dia. x 11/16" long. Cast aluminum construction. Approx. size 4½" x 4½" x 4". **$18.50 ea.**

SMALL DC MOTORS

(approx. size over 3¼" x 1¼" dia.:
5067043 Delco 12 VDC PM 1" x 1" x 2", 10,000 rpm. $7.50
5067126 Delco PM, 27 VDC, 125 RPM, Governor Controlled 15.00 ea.
5069600 Delco PM 27.5 VDC 250 rpm 12.50
#5069625 120 rpm, mfr. Delco, 27 VDC governor controlled $15.00
5069230 Delco PM 27.5 VDC 145 rpm 15.00
5068750 Delco 27.5 VDC 160 rpm w. brake 6.50
5068571 Delco PM 27.5 VDC 10,000 rpm (1x1x2") 5.00
5069790 Delco PM, 27 VDC, 100 RPM, Governor Controlled 15.00 ea.
#5069800 575 rpm, mfr. Delco, 27 VDC, PM reversible governor controlled, equipped with 27 VDC clutch $17.50
5072735 Delco 27 VDC 200 rpm governor controlled. 15.00
5BA10A118 GE 24 VDC 110 rpm 10.00
5BA10AJ37 GE 27 VDC 250 rpm reversible 10.00
5BA10AJ52 27 VDC 145 rpm reversible 12.50
5BA10AJ50, G.E., 12 VDC. 140 rpm 15.00
5BA10FJ401B, G.E. 28 VDC, 215 rpm, 10 oz. in., 7 amp. contains brake 15.00
5BA10FJ42T, G.E. 26 VDC, 4 rpm, reversible, 6 oz. in., .65 amp 15.00

400 CYCLE PM GENERATOR



115/200 volts A.C. 1- or 3-phase, 200 watts. 4,000 r.p.m. Approx. dimensions: 4½" dia.; 3" long; ⅛" shaft, AN connector. $75.00

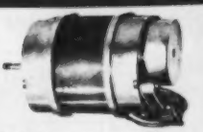
GENERAL ELECTRIC AUTO PILOT DIRECTIONAL GYRO INDICATOR and CONTROL UNIT

Mod. 8K63AC. 115 volts, 400 cps, 3 phase, 40 watts. Has settable induction pick-off. $10.00

MINNEAPOLIS-HONEYWELL RATE GYRO (Control Flight)

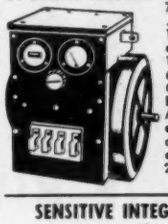
Part no. JG7005A, 115 volts A.C., 400 cycle, single phase potentiometer take off resistance 330 ohms. Speed 21,000 r.p.m. Angular momentum 2½ million, CM²/sec. Weight 2 lbs. Dimensions 4-7/32 x 3-29/32 x 3-31/64.
Price $22.50

SELSYNS-SYNCHROS



1CT cont. Trans 90/55V 60 cy. $27.50
1DG Diff. Gen. 90/90V 60 cy. 34.50
1F Syn. Mtr. 115/90V 60 cy. 34.50
1G Gen. 115V 60 cy. 34.50
1HDG 37.50
1HCT 37.50
1SF Syn. Mtr. 115/90V 400 cy. 12.50
23TR4 torque receiver 34.50
23TR6 torque receiver 37.50
23CT6 control transformer 37.50
23CX6 control transmitter 37.50
23TX6 torque transmitter 37.50
7DG differential generator 7.50
2J1F1 Gen. 115/57.5V 400 cy. 10.00
2J1F3 Gen. 115/57.5V 400 cy. 7.50
2J1FA1 Gen. 115/57.5V 400 cy. 5.00
2J1G1 57.5/57.5V 400 cy. 7.50
2J1H1 Diff. Gen. 57.5V 400 cy. 17.50
2J5D1 Cont. Trans. 105/55V 60 cy. 17.50
2J5F1 Cont. Trans. 105/55V 60 cy. 17.50
2J5H1 Gen. 115/105V 60 cy. 17.50
2J15M1 Gen. 115/57.5V 400 cy. 34.50
5CT Cont. Trans. 90/55V 60 cy. 34.50
5D Diff. Mtr. 90/90V 60 cy. 34.50
5DG Diff. Gen. 90/90V 60 cy. 34.50
5F Syn. Mtr. 115/90 VAC 60 cy. 34.50
5G Syn. Gen. 115/90VAC 60 cy. 37.50
5HCT Cont. Trans. 90/55V 60 cy. 12.50
5SDG Diff. Gen. 90/90V 400 cy. 25.00
6DG Diff. Gen. 90/90V 60 cy. 34.50
6G Syn. Gen. 115/90VAC 60 cy. 42.50
7G Syn. Gen. 115/90VAC 60 cy. 20.00
C56701 Type 11-4 Rep. 115V 60 cy. 20.00
C69405-2 Type 1-1 Transm. 115V 60 cy. 20.00
C69486 Syn. Transm. 115V 60 cy. 20.00
C69406-1 Type 11-2 Rep. 115V 60 cy. 12.50
C78248 Syn. Transm. 115V 60 cy. 20.00
C78410 Repeater 115V 60 cy. 30.00
FPE 49-7 Diehl servo motor, 115 volts, 60 cycle, 10 watts. .....

400 CYCLE, 3 PHASE GENERATOR BY MASTER ELECTRIC



Type AG, frame 364Y, 7.5 kw, 3428 rpm, pf .95 Star connected 120/208 3 phase, 22 amps. Delta connected 120 volt single phase 6 amps. Self excited. Complete with control box, voltage regulator, AC voltmeter and frequency meter. Shaft 1" dia., 2" long; overall dim. of unit: 21"dx18"x 20".
Price $395.00 each

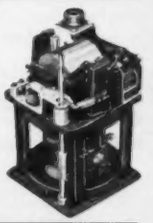
SENSITIVE INTEGRATING GYROS

This is the famous HIG Gyro which is being used in missile guidance systems, radar stabilization and fine control systems. Government cost approximately $1500.
PRICE $50.00

400 CYCLE PM GENERATOR

Mfgd. by T K M Electric Corp.
Model #A-12
120/208 volts, 400 cycle, 1 or 3 phase, 1 kva, pf 0.8, rpm 8,000. Approx. dim. 6" x 5½". Internal spline drive. Price $100.00

SCHWEIN REMOTE CONTROL DUAL GYRO

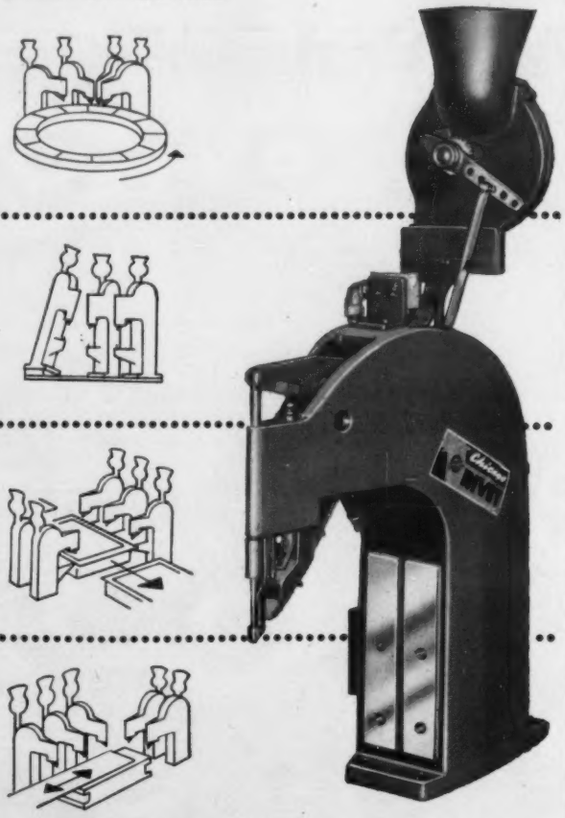


Type 45600 free and rate gyro. Contains two 28VDC constant speed gyros . . . vertical and horizontal. Both gyros exceed 30,000 RPM. Size: 8" x 4½" x 4½". Complete with metal cover.
PRICE $15.00

DIRECTIONAL INDICATOR, TYPE C5C

Mfgr. Summers Gyroscope Company. 115-volt A.C., 400 cycle, 3 phase. Contains direct reading gyro with caging mechanism, and power failure indicator. Hermetically sealed case. 5" dial, 0 to 360°.
PRICE $22.50

A FEW OF MANY POSSIBLE RIVETING HEAD POSITIONS THAT CAN BE USED



Rotating fixture showing suggested arrangement of riveting heads.

Riveting heads can be positioned for fastening on flat or curved assemblies.

Conveyor Belt permits multiple setting on both sides of an assembly.

Sliding fixture used for riveting 2 sides of an assembly.

AUTOMATE RIVET SETTING

for new low costs

For years assemblies made of metal and non-metal or a combination of both have been fastened most economically with semi-tubular rivets. And now even lower costs are possible with the thin-nose riveting heads designed by Chicago Rivet. These heads, pneumatically operated but electronically controlled, can be grouped in clusters on one or more planes and will set rivets as close as $^{13}/_{16}$" apart. Automation, thru rotating sliding or continuous belt feeding and riveting stations, is possible. Riveting heads may be repositioned and used again on new assemblies.

CUSHIONED RIVETING REDUCES BREAKAGE

A pneumatic riveter upsets the rivet with a squeezing action which minimizes breakage and automatically compensates for slight variation in assembly thicknesses.

The suggestions of Chicago Rivet fastening specialists will prove most helpful. Call them—no obligation.

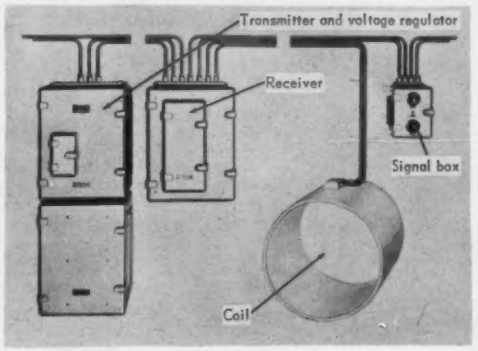
AIR-POWERED RIVETING CATALOG contains description and specifications of 8 single and multiple riveters—also rivet setters designed for automation.
RIVET CATALOG describes 1388 standard tubular and split rivets and 25 single and multiple motorized automatic rivet setters.

Chicago Rivet & MACHINE CO.

961 So. 25th Ave., Bellwood, Ill. (Chicago Suburb) • **Branch Factory: Tyrone, Pa.**

Circle 106 on Reader-Service Card for more information

IDEAS IN THE NEWS



• **TRANSISTORIZED INSPECTION UNIT** automatically checks logs for stray metal parts. Logs pass through an electromagnetic coil. Presence of ferrous or nonferrous pieces in the wood triggers a relay and an alarm device.

Coils are sheathed in lightweight concrete or glass-fiber-reinforced plastic. Cross-sections may be round or oval; for flush installations, a flat version is also available. Preferred mounting is on a raft which follows the water level and seasonal changes in the entrance to the log holding pond. Size of the smallest ferrous piece detected is roughly one-hundredth of the coil diameter; minimum size for copper or aluminum is twice as large.

Minimum interference-free sensitivity has a radius equal to five times the coil diameter for moving metal components such as sawblades. Coils may be located up to 165 ft away from the receiver.

Coils are balanced at the receiver and operate under ± 15 percent line voltage variation, ± 10C temperature variation. The unit uses 200–250w from a 220v, 50-cycle line. Transmitter frequency is synchronized with line frequency, which should be constant within ± 1 percent.

Logs are passed through the coil by a rubber conveyor. A 32-inch-dia coil handles 500 to 1000 10-inch-dia logs per hour.

Signals arriving at the alarm box optionally set off a bell, horn, buzzer or lamp. These signals cause log to bypass the chute, stop the conveyor or trigger a paint spraygun for visual marking.

Contaminated logs are segregated in an "iron pond". Metal inclusions are pinpointed by a portable detector and removed; remainder of log is salvaged for production. The detector is a fully transistorized unit using 4 standard 1.5v cells and weighs 7 lb with headphones.

Metal detector unit MD 113 T and portable detector M 213 are products of Valtion Sahkopaja, Leppavaara, Finland. R.F.S.

ACHIEVEMENT IN PRECISION

Precision in design and manufacture is not sufficient to put your product up in the PRECISION orbit. Precision in thought, resulting in precision planning and organization is also required. This faculty which underlies our creative engineering, our craftsmanship and our manufacturing skill is our greatest resource. To this we owe our leadership in the design and manufacture of precision electrical, electro-mechanical and electronic products for the modern, ever-growing fields of instrumentation and automation.

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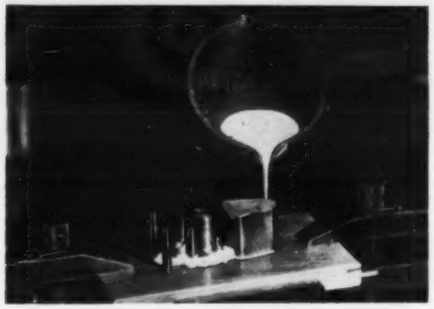
CERROTECHNICS *saves* **TIME & MONEY**
in Anchoring Punches
in Punch Plates



CERROTECHNICS — the technology of using CERRO* ALLOYS to expedite industrial operations

Guided by die plate, punches are located in oversize holes in punch plate. Cap screws inserted into punch bases through auxiliary plate hold punches while CERROMATRIX is poured. Cuts costs 50% to 90%. Send for full information.

*T.M. Cerro Corp.

CERRO SALES CORPORATION
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LIMIT SWITCH ARM
WITH
Micrometer Adjustment

gives precise angular position of arm after switch is mounted

- Mounts on any Class 9007 Type AW limit switch
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- Adjustment through full 360°
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SQUARE D COMPANY
wherever electricity is distributed and controlled

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• **EXPERIMENTAL DEVICE** will protect operators of optical equipment from nuclear flash blindness in the battlefield. The eye-protection mechanism can effectively close out the light from a nuclear flash in one ten-thousandth of a second.

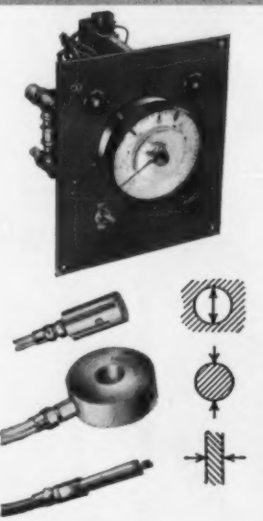
Lenses of binoculars and telescopes collect far more light than the human eye. Thus, the brilliant light of a nuclear detonation, although miles away, would be funneled into the retina of the eye, either severely damaging it or causing permanent blindness.

Heart of the eye-protection device is a stressed-plate shutter placed in front of the objective end of a pair of binoculars or a telescope. When a sensing device detects a nuclear detonation this shutter closes out the resultant flash with an effectiveness in excess of 1000 to 1.

The stressed plate shutter is a nonmechanical device consisting of an ordinary piece of glass plate mounted between a pair of rigid beams. Placed at either end of the beams are stacks of piezoelectric drivers. Voltage applied to these driver stacks causes them to expand or contract, depending upon the voltage polarity. This strain is transmitted to the shutter plate. Strain induced in the glass will change the state of polarization of a light beam passing through the shutter plate.

Mounted between a pair of crossed or parallel polarizers, the light beam will be modulated from full-open to full-closed. The eye-protection device was developed by Electro-Optical Systems, Inc., Pasadena, Calif.

GAGE PAGE
A Quick Run-down of New Gaging Ideas

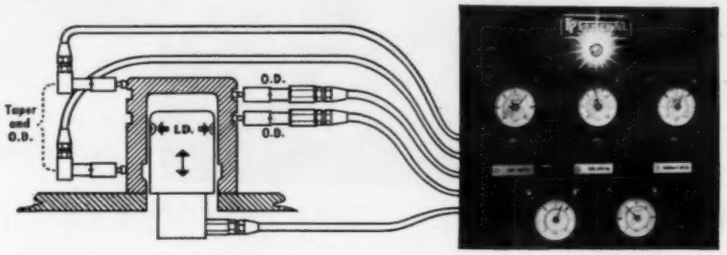


THE MOST PRACTICAL WAY

. . . to check dimensional relationships such as hole location, taper, center distance, etc., is to gage with Air.

The FEDERAL Air Gaging System combined with electric control does the job rapidly . . . embraces complete selection of building-block components . . . measures inside and outside diameters, eccentricity and squareness — rapidly and economically . . . best system for otherwise inaccessible dimensions.

Cut multiple-dimension inspection time in half with Modular Unit readout . . . single master "good" light indicates at a glance all checks within tolerance . . . "over" and "under" lights for each out-of-tolerance dimension . . . individual meters for direct reading. Designed for panel mounting — each unit compact, self-contained and quickly replaceable.



For complete specs, dimensions — the *whole* story — send for Catalog 60 AM.

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FOR RECOMMENDATIONS IN MODERN GAGES . . .
Dial Indicating, Air, Electric, or Electronic—for Inspecting, Measuring, Sorting, or Automation Gaging

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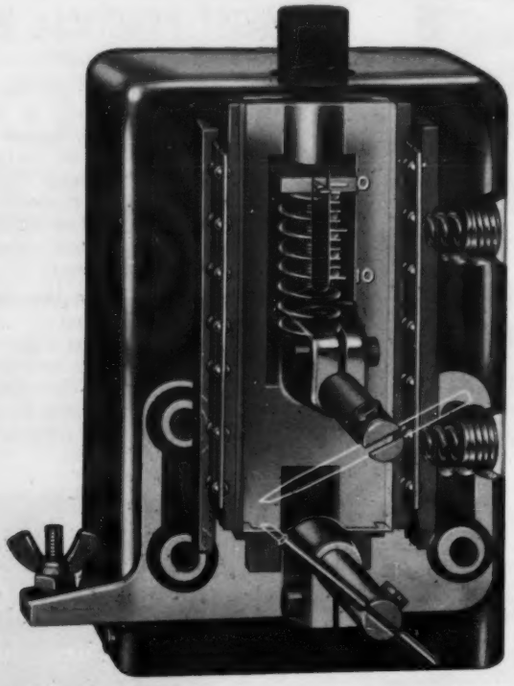
Design News
stimulating Design Activity through...
USABLE DESIGN IDEAS

*CIRCULAR PULLEY designed by LEONARDO DA VINCI, 1452-1519

THIS WELDMATIC WELDING HEAD IS USED TO PRODUCE MORE MODULES THAN ALL OTHER MAKES combined



Here's why—

Fastest Follow-Up

Model 1032 combines (1) near-zero inertia of lightweight electrode arm with (2) minimum friction (thanks to self-adjusting spring loaded linear raceways) and (3) low spring-rate driving force, to supply *ultimate* acceleration capability throughout the weld formation period. The vital combination of these 3 factors determines the resultant Weld-Schedule optimum "maximum-strength" area.

Absolute Linear Electrode Movement

Long linear ball-bearing raceways allow only perfect, non-wiping action—wiping action being a major contributor to mediocre welds.

True Force Firing

Patented, pure force-firing action is designed into the Model 1032. Weld energy is released to the electrodes only—and exactly--when the preset force is reached, regardless of setup configuration.

Self-Adjusting Raceways

Dual, linear ball-bearing raceways, spring loaded for full compliance, compensate for wear, thermal effects, and normal dirt and provide absolute, lowest constant friction over full electrode arm stroke.

Minimum Movable Mass

All parts moving during follow-up total less than 4 ozs. Die-cast electrode arm and holder, with electroplated high conductivity interfaces, offer highest welding efficiency yet lowest mass.

Full Flexibility and Accessibility

The head features full frontal 3-dimensional access with fully adjustable arm lengths. The head operates at any desired work position, either singly or in double head combinations.

Full Line of Tailored Accessories Available

Optimum production weld repeatability results through minimizing operator fatigue. Tailored accessories such as actuators, illuminator, magnifiers, riser assembly, horizontal adaptor, etc., provide these results.

For detailed specifications write:

WELDMATIC DIVISION / UNITEK

950 ROYAL OAKS DRIVE, MONROVIA, CALIFORNIA

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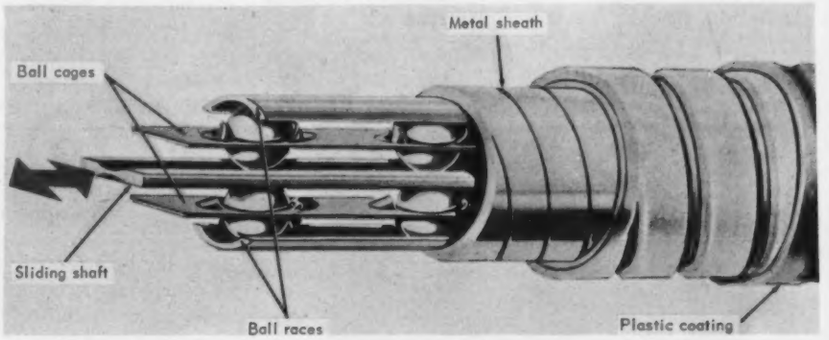
IDEAS IN THE NEWS



• **FLEXIBLE SHAFT** for remote control of linear motion slides between guide balls, minimizing friction loss, wear and maintenance. Satisfactory efficiency and reliability are obtained even with distances exceeding 20m (65 ft) and sharp bends.

Two opposite rows of balls bear against the shallow-grooved faces of the flat shaft. Light perforated strips form the ball cages while curved rails form the ball races. The whole mechanism is in a flexible sheath coated with polyvinyl chloride to resist chemicals and mechanical stresses.

Parts in contact with guide balls are made of stainless steel to provide long-lasting operating efficiency without lubrication. Various models of this transmission cable are available, with simple or double shaft, for pushing and/or pulling forces up to 1000 kg (2204 lb). The flexible shaft was developed by Flexiball Italiana SpA, Turin, Italy.

C.O.L.

Measure Speed and/or Torque

with any TORQUEMETER and

's NEW "TACHLITE" (Strobe-Tachometer) No. 790

• DRIFT-FREE • POSITIVE SPEED READING • HIGHLY SENSITIVE

. . . Here is the ideal complete combination for dynamic torque and speed measurements.

The "Tachlite" is also designed for many other applications including positive speed readings, machine demonstrations, and general laboratory work. Provides accurate and simple method of viewing objects under the stress of motion and reading of rotating dials when they form part of another measuring instrumer.t.

Suitable for measuring speed and "stopping motion" with P.I. No. 912 Photo Pickup or P.I. No. 813 Magnetic Pickup, or any audio oscillator.

WRITE for complete, informative literature TODAY!

TACHLITE Power Instruments

POWER INSTRUMENTS, INC.

7352 North Lawndale Ave. • Skokie, Illinois

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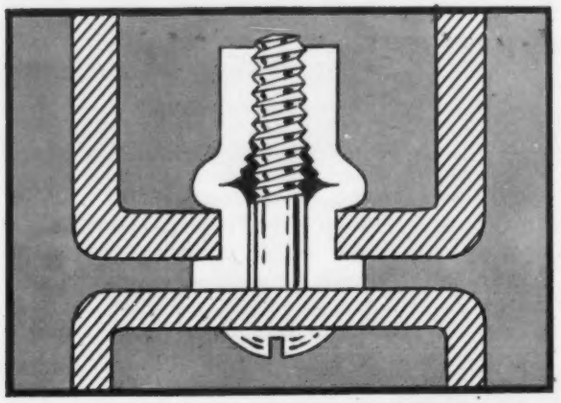

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B.F.Goodrich RIVNUTS are used throughout mobile equipment which is subject to continual vibration and shock. RIVNUTS can't shake loose; provide strong nutplates even in thin-gage metal. For your fastening problems investigate RIVNUTS—the first one-piece blind rivets with internal threads.

For RIVNUT Data Book write Dept. DN-11, *B.F.Goodrich Aviation Products, a division of The B.F.Goodrich Company, Akron, Ohio.*

B.F.Goodrich **Rivnuts**

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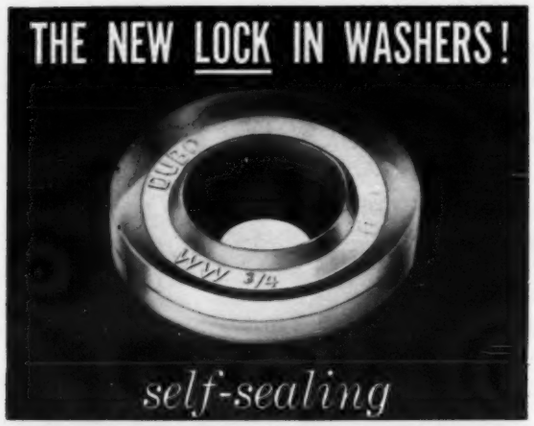
THE NEW LOCK IN WASHERS!



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Unique, positive lock and seal action — when nut is tightened, "cold-flow" action of plastic washer results in perfectly tight seal.

No loss of holding power — you can use rugged Dubo Lockwashers time and again.

Impossible to fit wrongly — fit perfectly every time because they are symmetrical with no threaded parts.

PLUS . . . excellent electrical properties . . . exceptional wear resistance . . . good shock absorption . . . resist corrosion, chemicals . . . non-flammable . . . high flexural strength.

Especially useful for electrical insulation, or for control of electrolytic corrosion between dissimilar metals.

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NON METALLIC FASTENINGS OF ALL TYPES

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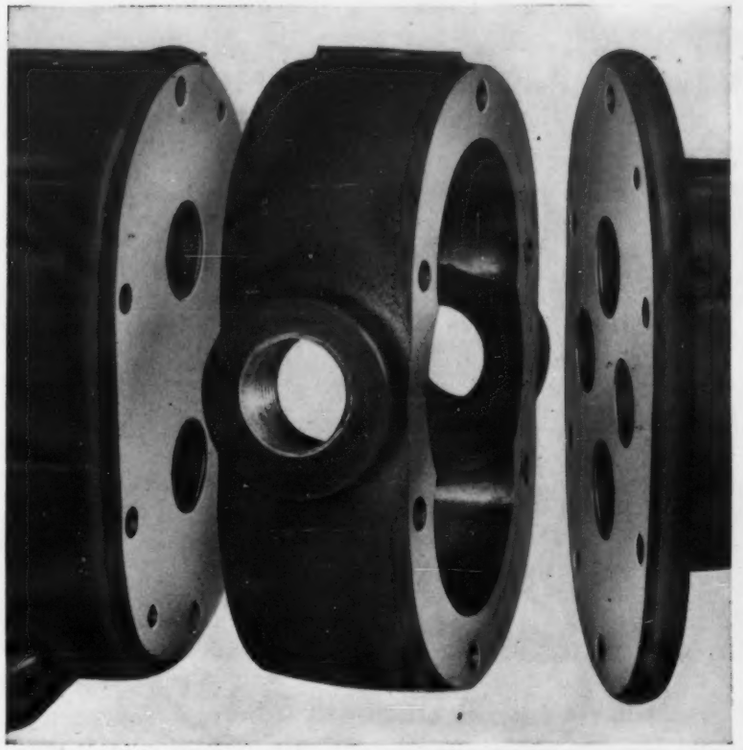
• **ANALYSIS** of chemical elements present on the surface of the moon may be accomplished by means of a nuclear technique under development at the University of California, Berkeley. The project involves bombardment of the moon's surface by nuclear particles, analysis of the resulting gamma radiation and transmission of the data back to earth.

Research has shown that each of the various elements expected to occur on the moon, when bombarded by neutrons, gives off a unique form of gamma radiation. The ultimate goal is to design a 35-lb instrument package to be mounted on a moon rocket and to contain a small particle accelerator, a detector and analyzer of gamma radiation and shielding. Data from the detector and analyzer would be fed into the rocket's central communications system and transmitted back to earth.

• **PRACTICAL METHOD** for producing large high-purity, high-density single crystals of tungsten has been developed by Westinghouse Lamp Div., Bloomfield, N.J. These crystals now are available commercially.

It is possible to grow single tungsten crystals as large as 10 inches long and 0.22 inch in dia with a purity of 99.9975 percent. Ultrapure single crystals are ductile even at temperatures as low as minus 330F, allowing tungsten sheets 3 ft long, 1/2 inch wide and 5 mils thick to be cold-rolled from a single crystal.

Zone-melting equipment, using the electron beam principle of heating, is used to produce the crystals.



No padding required! Flat, smooth faces of B&S pump parts mate perfectly, with nothing but a thin coat of shellac in between. Accuracy of clearances is not dependent on choice of gaskets. It is "ground-in" — and stays that way.

Why do we leave the gaskets out of Brown & Sharpe Pumps?

Gaskets vary in thickness — from piece to piece; with tightening; with age. They often shorten the life of a pump, or undermine its efficiency — by throwing internal clearances out of whack.

That's why Brown & Sharpe takes the trouble to grind its pump housings to close tolerances . . . to provide interchangeability without need for gaskets . . . *to save a lot of trouble* for you!

Dependable? You bet! They go right on pumping, when other pumps have quit! Write for details. Brown & Sharpe Mfg. Company, Providence 1, Rhode Island.

Extra-dependable B&S rotary gear pumps are used in every major industry. Pressures: to 1000 psi — Capacities: to 175 gpm — Viscosities: 32 to 50,000 ssu.

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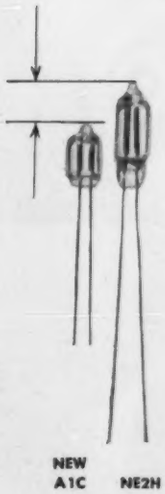
SAVE 1/4 INCH WITH THIS NEW TINIEST GENERAL ELECTRIC GLOW LAMP



Here's an indicator light that's only two-thirds the size of G-E glow lamps formerly available. Yet it lasts as long and has equal brightness. It's available as a high brightness lamp (A1C) and a standard brightness lamp (A1B).

This new General Electric glow lamp packs 5 mm electrodes into an M.O.L. of ½". Its maximum diameter is .244". It operates on standard line voltage, and because it uses a higher value resistor than a conventional glow lamp, it runs on half the current. This ½" long lamp, therefore, has a reduced total light output but because its brightness is not reduced, it is just as effective an indicator as other glow lamps in most applications.

You can get this new glow lamp for less than 5¢ each in lots of 25,000. (Slightly more with a resistor attached.)

For complete information write: General Electric Co., Miniature Lamp Dept. M-151, Nela Park, Cleveland 12, Ohio. Ask for Bulletin No. 3-1504.

Progress Is Our Most Important Product

GENERAL ELECTRIC

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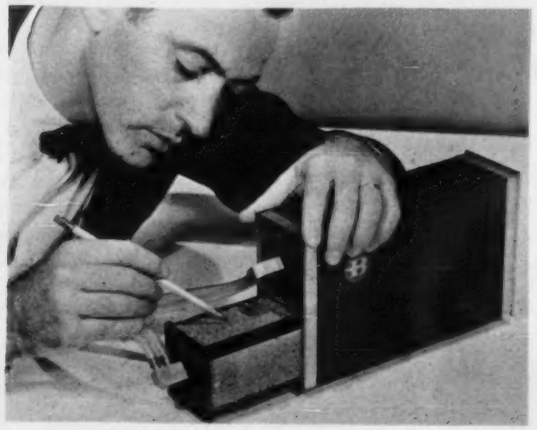
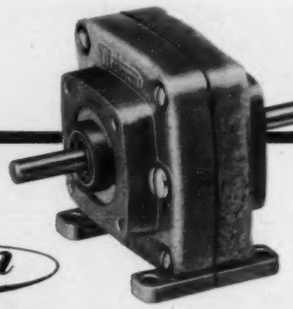
IDEAS IN THE NEWS

• **MINIATURIZED ELECTRONIC COMPUTER**, the size of a loaf of bread, is capable of performing calculations at the speeds of a room-sized computer. The computer was built to show how a new method of miniaturized computer construction makes it possible to shrink a commercial computer from room size to the size of a desk.

The "digital differential analyzer" has 5500 components housed in a space measuring 3 by 6 by 11 inches and a component density of 69,000 components per cu ft. The computer weighs 12 lb and can perform 33,000 mathematical calculations per sec.



ONE OF TWO "LOGS" is partially removed. Logs contain central heat exchangers and rows of triangular "chips" which encase electronic components.



FROM Metron

BANTAM SPEED CHANGERS

RATIOS: 646 from 1:1 to 85184:1
HORSEPOWER: 0.1 maximum
TORQUE: 130 oz-in
SPEED: 10,000 RPM maximum
BACKLASH: 15' maximum (Series 11)
WEIGHT: 16 to 45 oz depending upon ratio
BEARINGS: double, heavy-duty ball
DELIVERY: 10 days

A PART OR A PACKAGE

Bantam speed changers are only one product in Metron's complete line of small speed changing components. Call on our egnineers for design help with your speed changing or control problems. Tell us what *results* you're after—what your inputs and loads are. We'll come up with an output package to do the job efficiently and economically. Send your prints today!

Metron **METRON INSTRUMENT CO.**
5310 So. Delaware, Littleton, Colo. PY 8-2537 DDD: 303 TWX: DN 194

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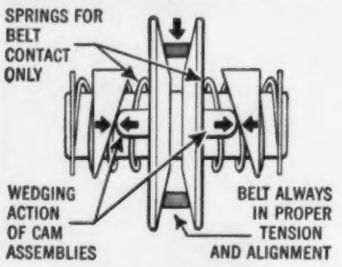
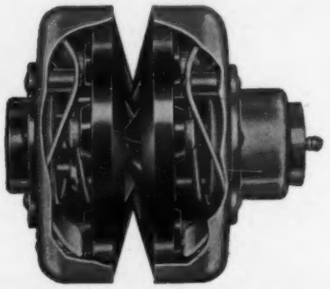
HOW HI-LO'S CAM CONTROL GIVES GREATER VARI-SPEED EFFICIENCY





1. Opposite wedging action of the exclusive patented cam and cam follower assemblies prevents pulley spread.
Result: constant speed is maintained at all times, even under overload conditions.

2. Cam action also automatically compensates for tension and alignment.
Result: belt is never under more tension than required by the load, always in proper alignment.

3. Springs are not driving members but serve only to keep pulley faces in contact with the belt.
Result: smooth and steady transmission of power, belt is never subjected to excessive spring pressure and lasts longer.

Hi-Lo Pulleys described above are available in standard V-belt series from fractional to 5 hp. (1750 rpm.), ratios to 2.6 to 1 and in wide V-belt series from 1 to 5 hp. (1750 rpm.), ratios to 3 to 1.

For full details on these and also Hi-Lo's economy and high ratio lines request Bulletin H-61 on company letterhead.

MANUFACTURED BY
HI-LO MANUFACTURING COMPANY

AFFILIATE OF
Lovejoy Flexible Coupling Co.
4962-H WEST LAKE STREET, CHICAGO 44, ILLINOIS

ROWS of triangular "chips", containing electronic components, wrap around central heat exchanger to form "logs".

The packaging system, termed "Macro-Module," has a finned heat exchanger as a central element in a "log" or row of triangular chips. The chips, approximately 3/8 inch thick and the height of a half-dollar, contain electronic circuitry and plug into a folding printed-circuit board. Additional compactness is obtained by folding (or actually wrapping) the board holding the upright chips around the heat exchanger. The chips fit snugly between the fins of the heat exchanger. Two such rows of chips, each 3 inches square and 10 inches long, contain the circuitry, logic, memory and other working parts of the computer.

The computer was built by Burroughs Corp., Detroit, Mich.

MEETINGS

University Park, Pa. **Dec. 11-13**	METAL JOINING SYMPOSIUM, The Pennsylvania State University.
Denver, Colo. **Dec. 26-31**	ANNUAL MEETING & EXPOSITION OF SCIENCE AND INDUSTRY, American Association for the Advancement of Science, Denver Hilton Hotel.
Las Vegas, Nev. **Dec. 27-28**	REGIONAL ANNUAL MEETING, American Society for Engineering Education.
Detroit, Mich. **Jan. 8-12**	ANNUAL AUTOMOTIVE ENGINEERING CONGRESS AND EXPOSITION, Society of Automotive Engineers, Cobo Hall.
Philadelphia, Pa. **Jan. 22-25**	NATIONAL PLANT ENGINEERING & MAINTENANCE SHOW, Convention Hall.

solve space problems in power seat

Here's why Chrysler Corporation uses flexible shafts in its six-way motion, power operated seat adjuster:

1. SPACE ECONOMY . . . "flexible shafts provided means to transmit power from a single electric motor, without compromising seat design."

2. REDUCED STRESSES . . . "flexible shafts act as torsion bars to reduce motor armature stresses induced when the mechanism was stopped or stalled suddenly."

3. RELIABILITY . . . "not a single shaft fatigue failure reported from the field to date."

4. LOW COST . . . "flexible shafts definitely represented savings without sacrificing design advantages."

Investigate for yourself how flexible shafts can solve many of your design problems and at the same time reduce costs!

S. S. WHITE INDUSTRIAL DIVISION,
DEPT. D 10 East 40th Street, N. Y. 17, N. Y.

THE S. S. WHITE FLEXIBLE SHAFT HANDBOOK
New 4th Edition . . . Send for your free copy!

1161

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FIRST NAME
IN FLEXIBLE SHAFTS

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W/L on target!

New METOHM line exceeds MIL-R-10509D

As a supplement to the unexcelled VITROHM resistors, Ward Leonard now offers to designers of commercial, military and industrial electronic equipment a line of molded metal film precision resistors, designed and tested to exceed the requirements of MIL-R-10509D, characteristics B, C and E. You can stake your reputation on Ward Leonard resistors.

Available in ⅛, ¼ and ½ watt sizes, W/L METOHM precision resistors feature the highest degree of built-in reliability and operating stability. Temperature coefficients, over the range −55°C to +175°C, may be as low as ±25 parts per million. Standard tolerance ±1%. Tolerances down to ±0.1% on special order.

METOHM TYPE	MIL EQUIVALENT	RATED WATTS	OHMIC VALUES		MAX. VOLTAGE RATING
			MIN.	MAX.	
WL 60	RN 60	⅛	30	500K	250 V.
WL 65	RN 65	¼	50	1 meg.	300 V.
WL 70	RN 70	½	50	1.5 meg.	350 V.

Write for complete specifications and a list of distributors. Ward Leonard Electric Co., 26 South Street, Mount Vernon, New York. O-10

RESULT-ENGINEERED CONTROLS

WARD LEONARD ELECTRIC CO. MOUNT VERNON NEW YORK

RESISTORS • RHEOSTATS • RELAYS • CONTROLS • DIMMERS

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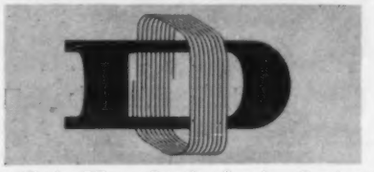

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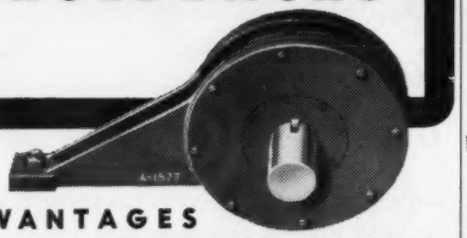

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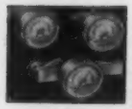

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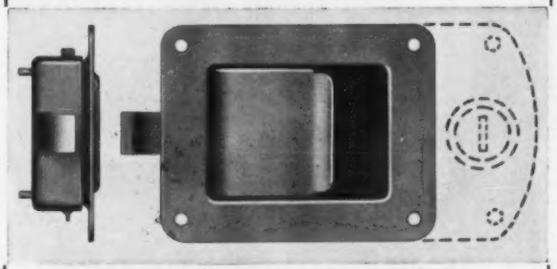
YOU CAN THINK of 100 IDEAL PRODUCT APPLICATIONS for The Circle E "4859 LATCH"



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You need CAGEROL bearing performance if higher speeds and increased misalignment have prevented the utilization of needle bearing load capacity in your applications. CAGEROL bearings can deliver up to ten times more expected life where misalignment and increased speeds exceed the capacities of ordinary end guided needle bearings. McGill construction features tapered retainer pockets for balanced roller guidance, crowned rollers, and black oxide retainer finish. CAGEROL bearings are interchangable with all heavy duty needle roller bearings—with or without inners in two bore sizes.

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McGILL®
precision needle roller bearings

McGILL MFG. CO., Bearing Div., 203 N. LAFAYETTE ST., VALPARAISO, IND.

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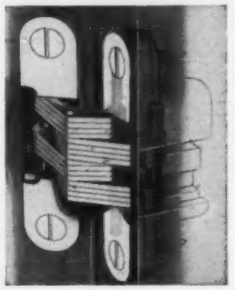
General Purpose Hinge Creates Flush Surfaces



These hinges are completely hidden from view when door, lid or hood is closed. Makes possible flush, absolutely smooth surfaces that greatly enhance appearance and safety. Tapered body sections are precision castings of a special zinc base alloy having a tensile strength of 47,000 pounds per square inch. Operates in a 180 degree arc which permits full opening. Laminated link construction reduces friction and permits hinges to operate freely and smoothly. Hinges are reversible and may be used right or left hand. Available for wood or metal application in a wide variety of sizes.

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INSIDE or OUT there is only one . . .

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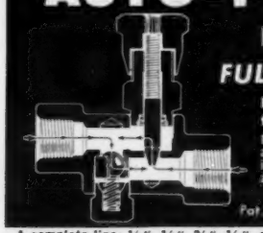
FULL FLOW VALVES



Flow Control, Needle, Check, for HYDRAULIC Power
Model KF Flow Control valve with Dial and Knob adjustment for direct reading and duplicating reference. Now available in Aluminum for 3000 psi.
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Model C Check Valve for In-Line Mounting.

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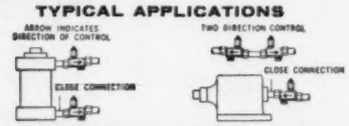

Controlling Double Acting Cylinder | Controlling Single Acting Cylinder

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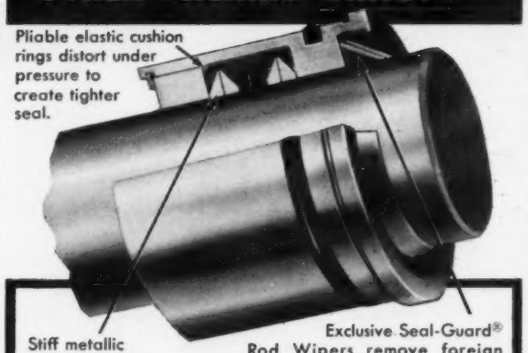
Pliable elastic cushion rings distort under pressure to create tighter seal.
Stiff metallic sealing rings
Exclusive Seal-Guard® Rod Wipers remove foreign particles from rod.

● Combines all essential packings, bearings and rod wipers in one complete package. ● Low friction coefficient for longer service life. ● Tamper-proof, shock and burst-proof. ● Needs no machining—easily installed or replaced. ● Trouble-free; cuts machine down-time.

Detailed literature on request.

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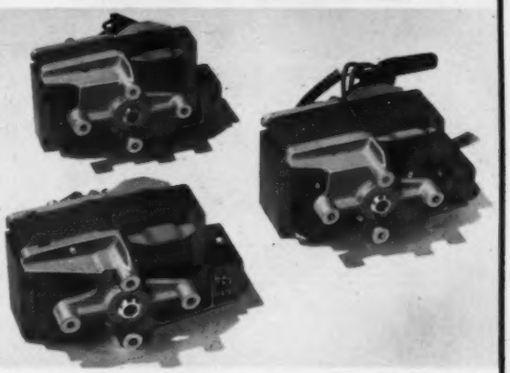

These three standard Syncro units deliver up to 1/4" amplitude at 14,400 strokes per minute. They're rated at 4, 3 and 2 amps full load at 115 vac. All feature a multiple torsion bar pivot bearing with no wear surfaces. Their sophisticated, trouble-free design has gained wide acceptance on sanders, saws, polishers, coin sorters, slicers—even peanut butter spreaders. Why not test them on your vibrating power problem?

SYNCRO CORPORATION
OXFORD, MICHIGAN

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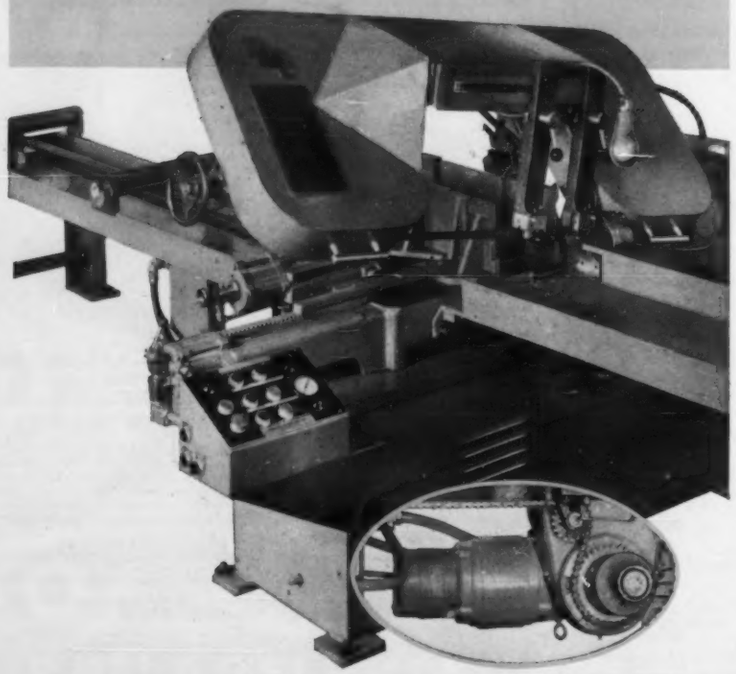
PEERLESS MACHINE COMPANY LETS DINGS DO IT



Guaranteed-uniform cuts at high speeds call for DINGS safe, sure stops

In automated cutting of billets, bars and structural shapes to extremely close tolerances, the conveyor must stop at precisely the right moment. That's why Peerless Machine Company relies on Dings Magnetic Disc Brakes for the fast, safe, sure stops necessary for their new automatic cycling, high-speed band saw. Operating at 14 feet per minute in forward or reverse, this machine is guaranteed by Peerless to hold length of cut to ±.003 of an inch.

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For *your* automated operations where fast precise braking is required, specify Dings Magnetic Disc Brakes. Call on Dings complete engineering service to help solve your specific brake problems.

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DINGS BRAKES, INC.
A SUBSIDIARY OF DINGS MAGNETIC SEPARATOR CO.
4710 West Electric Avenue
Milwaukee 46, Wisconsin

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PLANS AND CROSS-SECTIONS

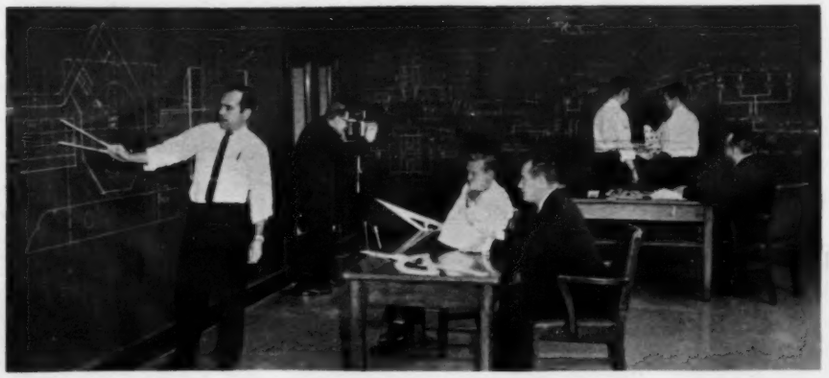
'Well. . .back to the blackboard'

Wall-sized blackboards on which engineers can develop their designs are part of a new engineering design technique developed by TAB Engineers, Inc. A finished drawing is copied photographically and the blackboard erased in preparation for a new project.

The "Panoramic Design Technique" has been applied to the company's development projects primarily to save the time normally needed to prepare detail and assembly drawings. It is estimated that projects using this technique have resulted in a 50 percent savings in both time and costs.

Additional advantages include the ability to have many engineers work on a design at one time, the possibility of continued supervision and assistance and the difficulty of loafing on the job.

Draftsmen who have mastered the art of sleeping while hunched over a drafting board will now have to learn to sleep standing up, perhaps hidden in a cloud of chalk dust.



Push Me to Your Leader. . .

Moon explorers in oversized space suits attached to four-wheeled carts have been proposed by A. B. Hazard of Aerojet-General Corp. The man-sized stroller would probably be powered by a fuel-cell system generating electricity for individual motors at each wheel. Oxygen, water and electric power would be fed to the space suit through a 20-ft umbilical cable, which would permit short exploratory walks. The space suit is large enough to allow the wearer to keep his hands inside if he wished, to eat and sleep and most important, to scratch.

Let's make it 0.0000035—roughly.

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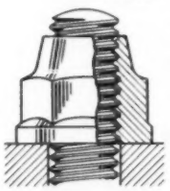

The threads in the tapered crown of the nut are slightly distorted from the round. When assembled to a companion threaded member, this out-of-round condition causes the nut to resist free entry of the mating part. As the metal flexes in an effort to conform to the circular pattern of the male threads, friction on the flanks of the nut threads is increased. The compressive forces exerted as a result of this diaphragmatic flexing action produce a positive, powerful locking grip.

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